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The Forest Resources of the Shawnee National Forest, 1998

David E. Haugen

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The Forest Resources of the Shawnee National Forest, 1998

David E. Haugen

The Shawnee National Forest in southern Illinois provides a diversity of landscapes not found elsewhere in the State (Iverson *et al.* 1989). Located in an area untouched by glaciers, the Shawnee's geology is stunning: sandstone bluffs and rough breaks which give way to gently rolling lowland plains and bottomlands.

The area that comprises the Shawnee National Forest has a rich history. Native Americans used the area's resources for over 15,000 years, and French and English explorers also played an important role. More than 1,230 historical and archaeological sites have been identified in the forest. Managing these sites and inventorying other cultural resources found in the forest are important components of Shawnee management (Iverson *et al.* 1989).

Plant life in the Shawnee is diverse and ranges from sun-loving species to those that grow in dense shade. Oak-hickory is the predominant forest type, but many other important tree species also occupy significant acreages. More than 500 wildlife species can be found within the Shawnee, including 48 mammals, 237 birds, 52 reptiles, 57 amphibians, and 109 species of fish (U.S. Department of Agriculture, Forest Service 2002).

In 1933, the National Forest Reservation Commission approved land purchases for the establishment of a national forest in Illinois. President Franklin D. Roosevelt, on September 6, 1939, designated the lands as the Shawnee National Forest (fig. 1). The national forest in Illinois is comprised of tax-forfeited land purchased from State and local governments, as well as land purchased from private individuals. Much of the area was degraded from exploitive timber harvesting, land clearing, and subsistence farming practices of the 1800s, resulting in soil erosion, depleted soils, abandoned farms in the early 1900s.

The Shawnee has shown a remarkable recovery since its inception and is currently providing the wide variety of benefits envisioned when it was created. Today, the Shawnee National Forest consists of 273.2 thousand acres in Alexander, Gallatin, Hardin, Jackson, Johnson, Massac, Pope, Saline, and Union Counties of Illinois.

This report provides information that describes, in a general way, the status and condition of forest resources of the Shawnee National Forest. Data for this analysis were collected as part of the 1998 Illinois forest inventory conducted by the North Central Research Station's Forest Inventory and Analysis (FIA) program. Estimates of change in the status and condition of forest resources are based on FIA data collected in 1985 (the previous Illinois inventory) and 1998. Data provided are estimates based on scientifically reliable survey techniques and estimation procedures. However, because data are estimates, and have associated sampling errors, the reader is advised to take into account the range associated with a particular statistic (see appendix for details). Also, the FIA program uses standard definitions and terms that may differ from those used by the Shawnee National Forest in management plans and other forest documents. This is especially true with land use information. Therefore, the reader is cautioned that information presented here should not be compared with information in the Shawnee National Forest's Land and Resource Management Plan (Forest Plan) or other documents without accounting for

About the Author:

David E. Haugen is a forester with the Forest Inventory and Analysis (FIA) unit at the North Central Research Station, St. Paul, Minnesota.

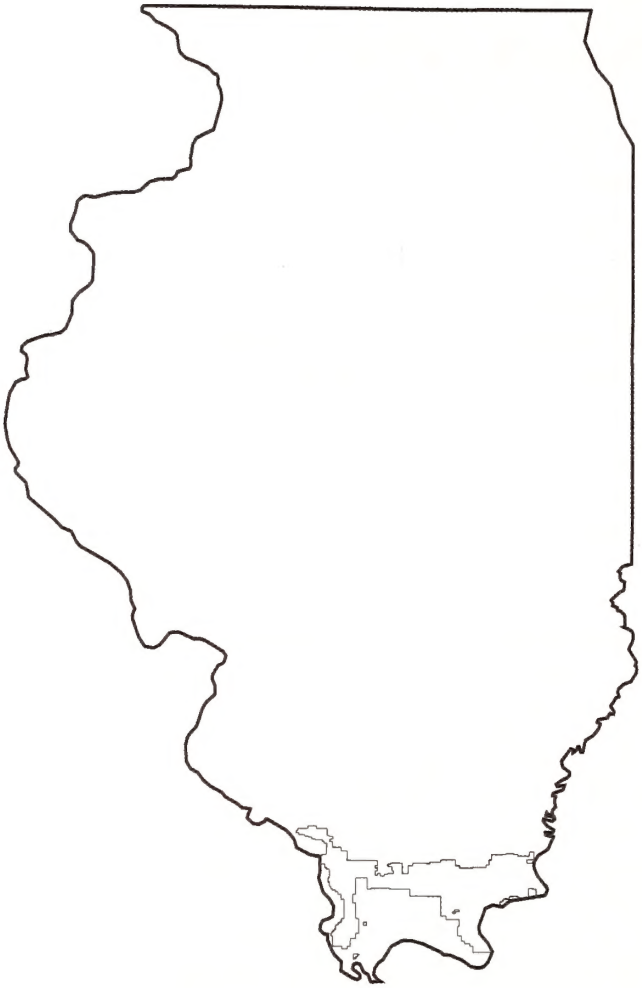


Figure 1.—*Location of the Shawnee National Forest. (Data source: ESRI® Data and Map.)*

differences in definitions and other considerations such as inventory methods. For example, the FIA timberland classification implies that land is capable of producing a sustained crop of wood and is not legally or administratively withdrawn from timber harvesting. However, this is not meant to imply that all timberland on the Shawnee is subject to harvest. The Shawnee's Forest Plan details the allocation of land for specific uses and management activities.

EXTENT OF FOREST LAND ON THE SHAWNEE NATIONAL FOREST

Of the 273.2 thousand acres of land in the Shawnee National Forest, 270.2 thousand are forested—an increase of 9 percent between 1985 and 1998. The remaining area consists of brush/shrublands, open areas such as wetlands and grasslands, and developed lands such as roads and utility corridors. More than 90 percent of the forested land within the Shawnee is classified as timberland and is capable of producing more than 20 cubic feet of industrial wood crops under natural conditions. The remaining forest lands (8.7 percent) have been withdrawn from timber use and are classified as reserved timberland.

FOREST COMPOSITION

The Shawnee National Forest has a variety of tree species because of its varied soil types, geological formations, climate, hydrological conditions, fire, and other natural/or human-caused disturbances. This variety of tree species contributes to the ecological diversity of the entire forest.

The Shawnee's forests are predominantly hardwood, with 94 percent of timberland area classified as hardwood forest types. In 1998, the dominant hardwood forest type on the Shawnee was the oak-hickory type with 170 thousand acres (fig. 2). Conifer forest types represented 6 percent of the total timberland area on the forest. The loblolly-shortleaf pine and white pine forest types were the two predominant pine types on the forest.

Between 1985 and 1998, the area of shortleaf pine, oak-gum-cypress, and oak-pine decreased and the area of maple-beech-birch, oak-hickory, and elm-ash-cottonwood increased (fig. 3).

Between inventories, the area of sawtimber-size and poletimber-size stands increased as the Shawnee's forests continued to mature (fig. 4). As the area of larger sized stands increased, area in sapling-seedling-size stands decreased. Decreases in smaller diameter stands can occur when a lack of significant disturbance through either natural occurrences or reduced levels of timber harvesting occurs. This allows trees measured during the previous inventory to put on enough diameter growth to be reclassified as either poletimber-size or sawtimber-size trees, thus changing the structure of the smaller stands so that the stands are reclassified as larger stands. In 1985, sawtimber-size stands accounted for 60 percent of the total stand area on the forest. However, by 1998, area in sawtimber-size stands increased to 71 percent of the total timberland area (fig. 4). Poletimber-size stands over the same period remained relatively unchanged (27 percent 1985, 26 percent 1998), while sapling/seedling-size stands decreased from 13 percent in 1985 to only 3 percent in 1998.

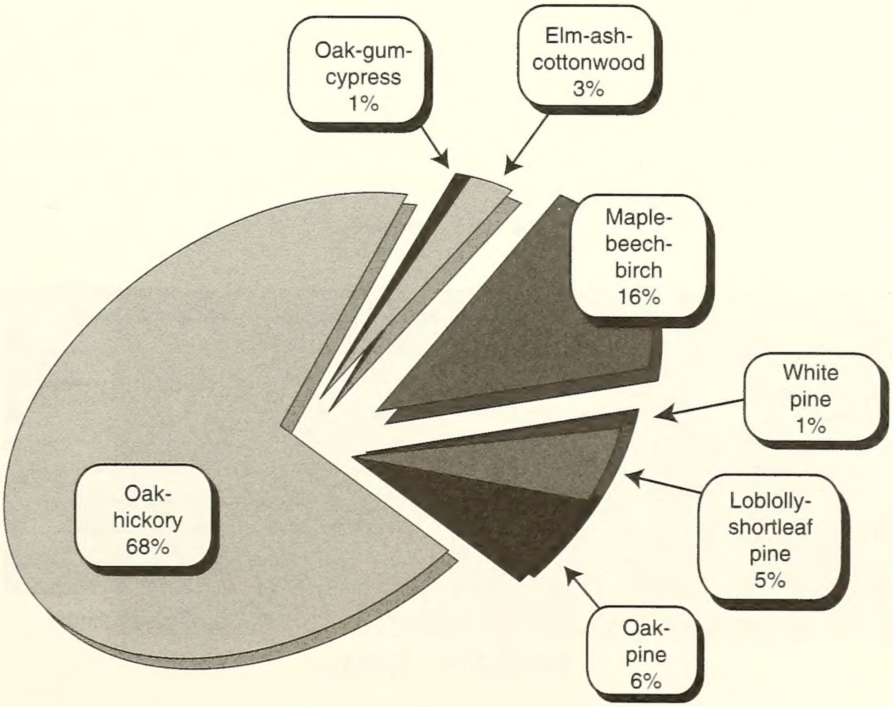
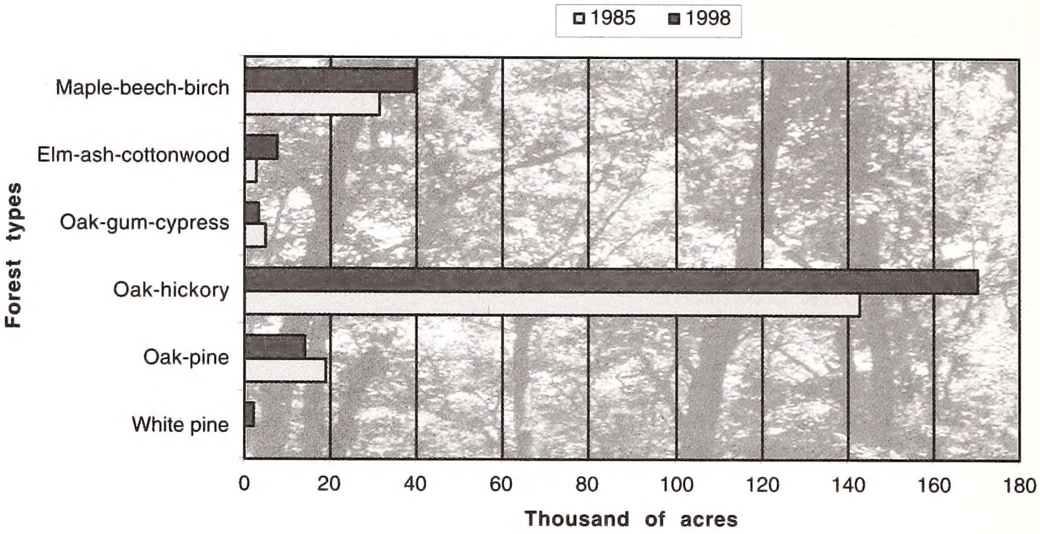


Figure 2.—*Area of timberland by major forest type, Shawnee National Forest, 1998.*

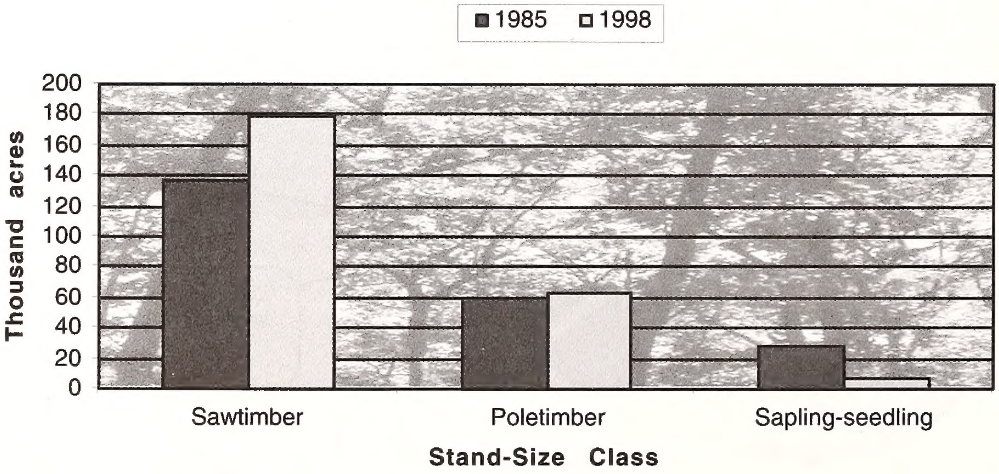
Figure 3.—*Area of timberland by major forest type, Shawnee National Forest, 1985 and 1998.*



Stocking, a measure used to determine how well land is occupied with trees, is usually measured as a function of basal area. Fully stocked stands are usually the goal of forest managers and provide the best opportunities for optimum growth and wood fiber production. Compared to the State average of 40 percent of the timberlands fully stocked, the Shawnee in 1998 had 64 percent of its timberlands considered fully stocked (fig. 5).

Potential productivity is an estimate of the volume growth per acre per year at culmination of mean annual increment of a fully stocked stand. The Shawnee's timberlands are very productive. Nearly 50 percent of the timberland area on the forest has the potential to produce more than 85 cubic feet of growth per acre per year (fig. 6). As a comparison, 30 percent of the timberlands on the Huron-Manistee National Forest in Michigan have a potential productivity of more than 85 cubic feet per acre per year.

Figure 4.—*Average stand-size class for timberland on the Shawnee National Forest, 1985 and 1998.*



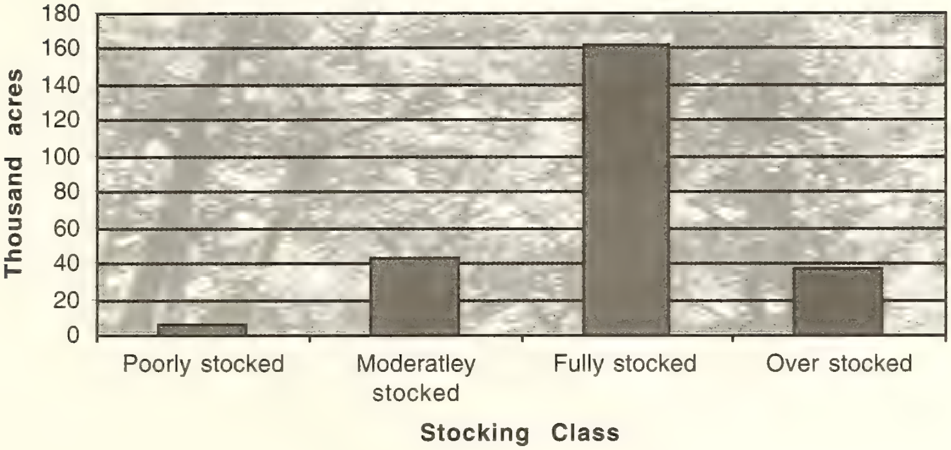


Figure 5.—*Area of timberland on the Shawnee National Forest by stocking class, 1998.*

Number of Trees

In 1985, the Shawnee had an estimated 121 million growing-stock trees at least 1 inch in diameter at breast height (d.b.h.). By 1998, the number of growing-stock trees had increased to 130 million, an increase of 7 percent between inventories.

Hardwoods dominate the Shawnee and account for 92 percent of all trees inventoried in 1998. Elm was the most abundant hardwood species group, with more than 19 million trees. Other hardwood species groups with more than 8 million trees each included sugar and black maple, hickory, white oak, and white and green ash.

The conifer species groups represented 8 percent of the total growing-stock trees on the Shawnee in 1998. Shortleaf pine with more than 5 million trees was the most prevalent conifer species on the forest. Other coniferous species are eastern redcedar, white pine, and loblolly pine.

Regeneration

Trees in the size class of sapling/seedling are generally recognized as regeneratrion (seedlings less than 1 inch d.b.h., saplings 1.0 inch to 2.9 inch d.b.h., and saplings 3.0 inch to 4.9 inch d.b.h.). Over all, regeneration on the forest increased from 91 million trees in 1985 to 98 million trees in 1998, an increase of almost 8 percent between inventories. At the same time, however, the number of trees in the 3.0-inch to 4.9-inch d.b.h. size class decreased by 21 percent between inventories (fig. 7).

As the forests on the Shawnee grow and mature, the limited ability of red and white oak species to regenerate under the shade of these forests is of special concern. The total number of growing-stock white oak trees in the 1.0-2.9, and 3.0-4.9-inch d.b.h. size

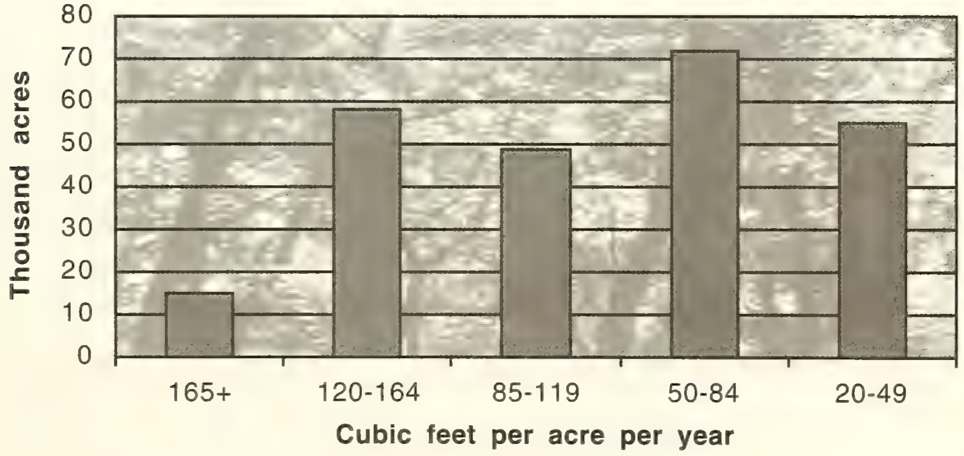


Figure 6.—*Area of timberland on the Shawnee National Forest by potential productivity class, 1998.*

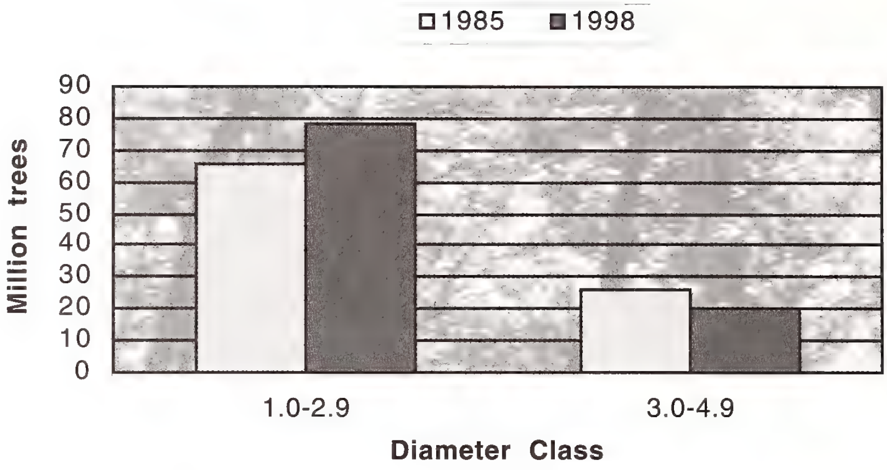


Figure 7.—*Total growing-stock regeneration in the Shawnee National Forest by diameter class, 1985 and 1998.*

classes decreased from 5.2 million trees in 1985 to 3.7 million trees in 1998, following a statewide trend (Schmidt *et al.* 2000). While 1.0-inch to 2.9-inch red oak trees in the 1.0 to 2.9-inch d.b.h. size class increased by roughly 6 percent (3.1 million to 3.3 million) between inventories, red oak trees in the 3.0-inch to 4.9-inch size class decreased by more than 60 percent (1.4 million to 0.5 million) over the same time period. As a comparison, hard maple species (black and sugar), which are shade tolerant, increased by 19 percent (8.6 million to 10.2 million) in the 1.0-inch to 2.9-inch class (fig. 8). There was a 79-percent increase (2.4 million to 4.3 million) in the 3.0-inch to 4.9-inch d.b.h. size class between 1985 and 1998. As forests go through successional changes in species composition, natural regeneration replaces existing overstory trees. Over time, changes in the composition of the forest can result in different forest type classification.

VOLUME

Growing-stock Volume

Between 1985 and 1998, growing-stock volume increased by over 1.1 million cubic feet, reflecting the increase in both forest area and stocking levels between inventories (fig. 9). Growing-stock volume in hardwoods increased by over 42 percent between inventories, and coniferous growing-stock volumes showed gains of over 16 percent between 1985 and 1998.

The increase in growing-stock volume corresponded to an increase in the average volume of timberland per acre. Average volume per acre increased from 1,332 cubic feet per acre in 1985 to 1,677 cubic feet per acre in 1998. The increases in growing-stock volume reflect, in part, the increased stocking levels on the forest.

In 1998, hardwood growing-stock volume accounted for 88 percent of the total growing-stock volume on the Shawnee. The hardwood species groups with the most growing-stock volume include white oak, red oak, hickory, and yellow-poplar, each with more than 30 million cubic feet.

Coniferous growing-stock volume increased by nearly 17 percent between inventories, from 43 million cubic feet in 1985 to over 50 million cubic feet in 1998. Although shortleaf pine decreased by 10 percent between inventories, it accounted for over 73 percent of all coniferous growing-stock volume in 1998. White pine, loblolly pine, and eastern redcedar all showed increases in growing-stock volume in 1998.

Sawtimber Volume

Sawtimber volume on the Shawnee increased from 976 million board feet in 1985 to 1.5 billion board feet in 1998 (measured in International 1/4-inch rule), representing a 60-percent increase between inventories. Due to State and local interest, the remaining sawtimber volume discussion will be based on the

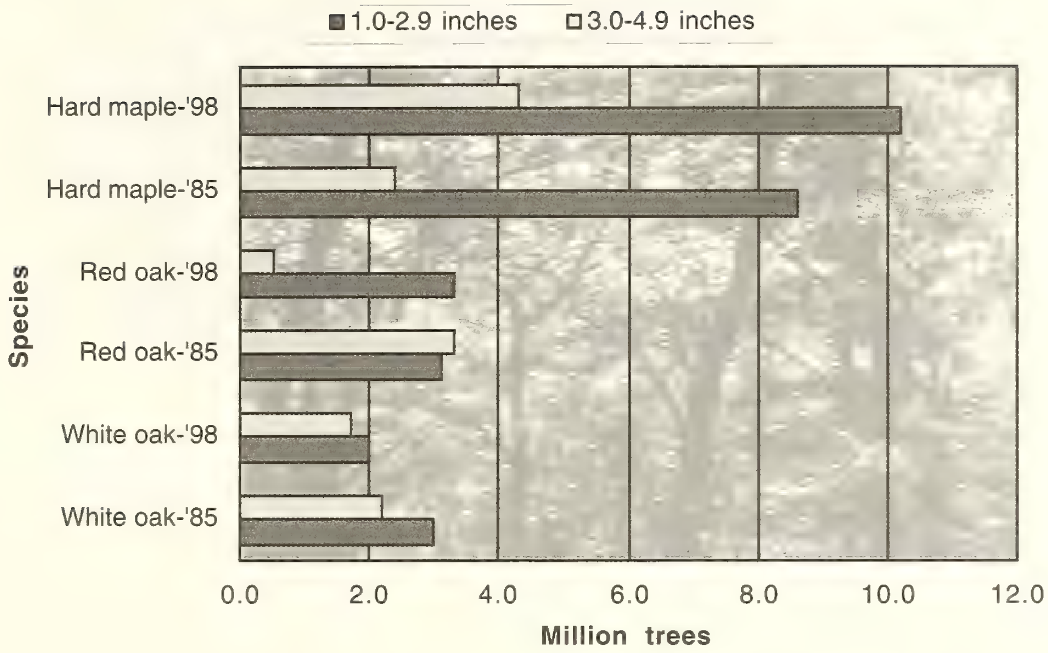


Figure 8.—*White oak, red oak, and hard maple regeneration in the Shawnee National Forest by diameter class, 1985 and 1998.*

Doyle rule of measure (see appendix for conversion factors). Sawtimber volume measured using Doyle is roughly 63 percent of the total sawtimber volume measured on the forest using the International 1/4-inch rule. Trends using the Doyle rule of measure tend to hold true for International 1/4-inch rule as well.

In 1998, the Shawnee had an estimated 980 million board feet (Doyle) of sawtimber volume, an increase of 66 percent since 1985. Over 42 percent of the total sawtimber volume is in trees 19 inches in diameter or larger.

Species groups with more than 100 million board feet (Doyle) of sawtimber volume in 1998 include white oak, red oak, and yellow-poplar (fig. 10). Combined, these tree species groups represent 66 percent of all sawtimber volume on the forest.

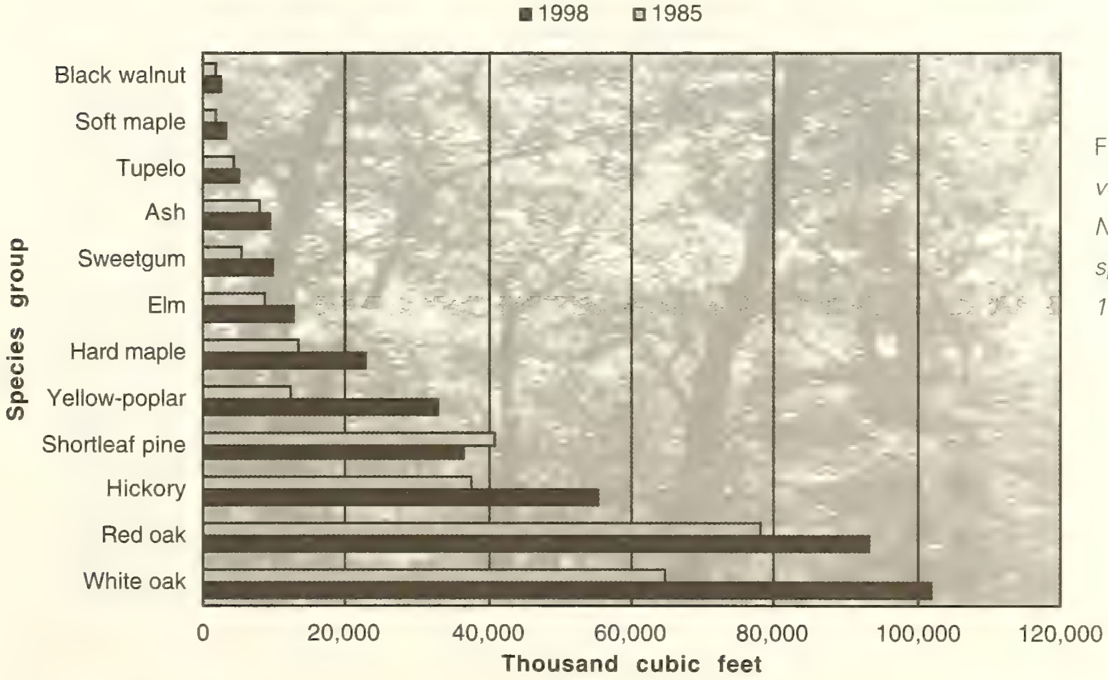


Figure 9.—*Growing-stock volume on the Shawnee National Forest by selected species groups, 1985 and 1998.*

Except for sycamore, river birch, and butternut, all hardwood and conifer species had gains in sawtimber growth between 1985 and 1998. On a percentage basis, the greatest gains in sawtimber volume were in white oak, hard maple, elm, black walnut, yellow-poplar for hardwoods and white pine, loblolly pine, and eastern redcedar for conifers.

CAUSES OF CHANGE

Both natural and human forces shape and influence the character of the Shawnee National Forest. One of the main goals of a forest inventory is to collect and analyze data pertaining to changing factors related to growth, mortality, and removals.

Growth

On the Shawnee, average annual net growth of growing stock on timberland between 1985 and 1997 was 14.2 million cubic feet per year (fig. 11). On a per acre basis, the Shawnee averaged 57 cubic feet per year in average annual net growth. This exceeds a statewide average for Illinois of 43 cubic feet per year in average annual net growth per acre on timberland.

Hardwoods accounted for 84 percent of the forest's total average annual net growth. Red oak, white oak, and yellow-poplar accounted for 42 percent of average annual net growth of growing stock. On average, these species groups had over 1.6 million cubic feet of growing-stock annual net growth between inventories. Shortleaf pine accounted for 48 percent of average annual net growth for conifer species between inventories.

Mortality

Although tree mortality has often been viewed as a loss of valuable wood fiber, mortality plays an important role in how a forest ecosystem develops. Dead and dying trees provide a variety of valuable wildlife habitat and help in stabilizing riparian zones within the forest. The causes of mortality on the Shawnee include diseases such as Dutch elm, verticillum wilt, white trunk rot; insects such as bole borers and ips beetles; weather-related factors such as wind, ice, drought, and flooding; and old trees reaching the end of their life span and natural competition with other trees.

Between inventories, average annual mortality of growing stock on the Shawnee was 3.3 million cubic feet. This equates to an average

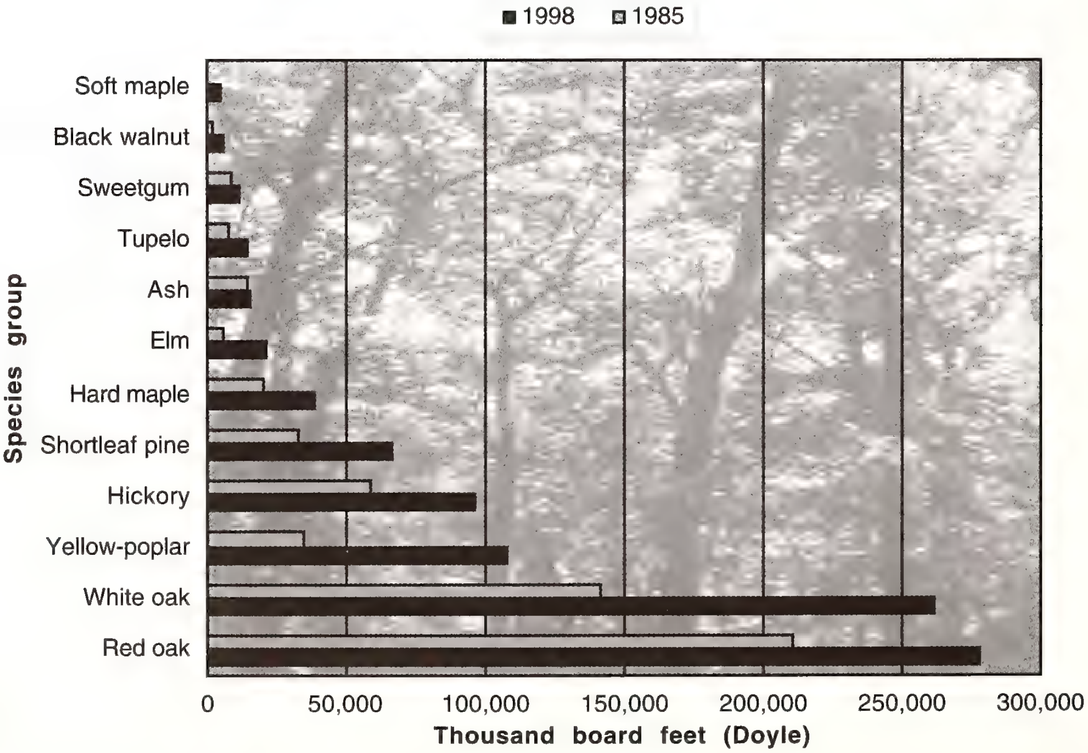


Figure 10.—*Sawtimber volume on the Shawnee National Forest by selected species groups, 1985 and 1998 (Doyle).*

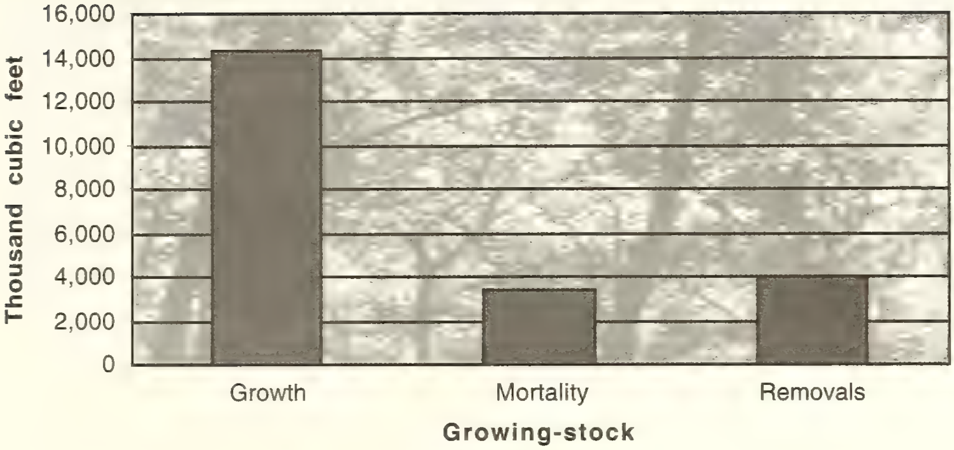


Figure 11.—*Average annual net growth, mortality, and removals of growing stock on timberland on the Shawnee National Forest between 1985 and 1997.*

annual mortality rate of 13.5 cubic feet of growing stock per acre for each of the 249 thousand acres of timberland on the Shawnee.

With an average annual mortality rate of 13.5 cubic feet per acre and a net growth rate of 57 cubic feet per acre, the Shawnee averaged a gross growth rate of 70.5 cubic feet per acre between inventories (gross growth equals net growth plus mortality). If mortality can be reduced through increased forest management, additional fiber could be available for harvest.

Hardwood species groups accounted for 94 percent of all mortality on the Shawnee. Red and white oak species groups accounted for over 50 percent of all growing-stock mortality on the Shawnee.

Removals

Between 1985 and 1997, the Shawnee's average annual removals of growing stock were 3.9 million cubic feet of growing stock. This equals an average annual removal rate of about 15.9 cubic feet of growing stock per acre for each of the 249 thousand acres of timberland on the forest. This removal rate represents about 1 percent of the total growing-stock volume on the Shawnee.

The average annual removal rate for softwood growing stock (746 thousand cubic feet) was 1.4 percent of the total softwood growing-stock volume. Average annual removals of hardwood growing stock were 3.2 million cubic feet, 0.8 percent of the total hardwood growing-stock volume.

Between 1985 and 1997, the main species groups removed on the Shawnee were red oak, shortleaf pine, white oak, hickory, sycamore, white and green ash, and hard maple. All of these species groups averaged 200 thousand cubic feet of growing stock or more harvested each year between inventories.

With a growth-to-removals ratio approaching 3 to 1, the Shawnee has the potential to increase its harvest rates due to the large volume of wood fiber that currently exists. To put it simply, over time the Shawnee National Forest has been growing more wood fiber than has been removed.

APPENDIX

PUBLIC ACCESS TO FIA DATA

The data presented in this report represent only a portion of the data collected. However, the data collected in both the 1985 and 1998 Illinois inventories can be easily accessed. Data can be obtained over the Internet by accessing the USDA Forest Service FIA Web site (http://www.fia.fs.fed.us) and entering the Online Databases. Data from the inventories of every State used to develop the 1997 Resources Planning Act (RPA) assessment can also be accessed at this site. Three independent databases are maintained at this site: the National FIA Database, the National Resources Planning Act (RPA) Inventory Database, and the National Timber Products Output (TPO) RPA Database.

The National FIA Database contains data from the previous (1985) and current (1998) ground plot-based inventories that were used to produce most of the estimates in this report. This includes all estimates of area; number of trees; volume; biomass; average annual net growth, mortality, and removals; and current net growth and mortality. The data are stored so that users can download portions of the database onto their own computers and produce their own estimates, or they can use an online table generation program to create user-specified tables similar to those presented in this report. This database is described in Miles *et al.* (2001) and is documented online. Copies of the database and a table generation program are also available on a CD-ROM, which can be obtained by contacting the Program Manager, FIA, North Central Research Station, 1992 Folwell Avenue, St. Paul, MN 55108, (651) 649-5139.

The National RPA Inventory Database contains data from all States and represents a "point-in-time" inventory. Illinois inventory results contribute to this database. RPA inventories are conducted on a 10-year cycle with midcycle updates every 5 years. RPA inventories differ from FIA inventories in that historically FIA inventories have been periodic and based on the year of completion of field work for any individual State. Results are published as soon as possible after the field work results are compiled and analyzed. RPA inventories use the FIA inventory results and update them to a common year. The most recent RPA inventory represents the FIA inventories of all 50 States updated to the common year of 1997. Results are published on a regular cycle. This database is available online at http://www.fia.fs.fed.us.

ACCURACY OF THE SURVEY

FIA information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are estimates only. A measure of reliability of these figures is given by sampling errors. The level of sampling error used by FIA means that the chances are two out of three that if a 100-percent inventory had been made, using the same methods, the results would have been within the limits indicated.

For example, the estimated growing-stock volume in the Shawnee National Forest in 1998, 418,261 thousand cubic feet, has a sampling error of ± 8.59 percent (±35,928 thousand cubic feet). The growing-stock volume from a 100-percent inventory would be expected to fall between 454,189 thousand cubic feet and 382,333 thousand cubic feet (418,261 ± 35,928), there being a one in three chance that this is not the case. The following tabulation shows the sampling errors for the Shawnee National Forest:

Item	Shawnee NF	Sampling error
Forest land	*Thousand acres*	*Percent*
Timberland area (1998)	249.3	6.51
Growing stock	*Thousand cubic feet*	
Volume (1998)	418,261	8.59
Average annual net growth (1986-1997)	14,309	8.55
Sawtimber (International 1/4-inch rule)	*Thousand board feet*	
Volume (1998)	1,559,136	9.62
Average annual net growth (1986-1997)	62,971	8.53

As survey data are broken down into sections smaller than forest totals, the sampling error increases. For example, the sampling error for timberland area in a particular forest type is higher than that for total timberland area in the forest. To estimate sampling error for data smaller than forest totals, use the following formula:

$$E = \frac{(SE)\sqrt{\text{(Forest total volume or area)}}}{\sqrt{\text{(Volume or area smaller than Forest total)}}}$$

Where:
E = Sampling error in percent.
SE = National Forest total error for volume of area.

For example, to compute the error on the area of timberland in the oak-hickory type for the Shawnee, proceed as follows:

1) Total area of oak-hickory type from table 2 = 170.2 thousand acres.
2) Total area for all timberland in the Shawnee National Forest from table 1 = 249.3 thousand acres.
3) Total Forest error for timberland area = 6.51 percent.
4) Using the above formula:

$$E = \frac{(6.51)\sqrt{249.3}}{\sqrt{170.2}}$$

E = 0.0787 or 7.87 percent sampling error for the oak-hickory forest type.

SURVEY PROCEDURES

The 1998 Illinois survey used a two-phase sample for stratification that remeasured the inventory plots from the 1985 inventory and used a growth model in the estimation of both current conditions and change over time. Two-phase sampling, also called double sampling, consists of a phase 1 sample used to estimate area by strata and a phase 2 sample to estimate the average value of parameters of interest within these strata. The estimated population total is the sum across all strata of the estimated strata area times the estimated mean.

The 1985 Illinois inventory was intensified to provide lower sampling errors and to improve county-level estimates. Funding to intensify the 1985 inventory was provided by the Illinois Department of Natural Resources, Division of Forestry. Because the 1998 inventory was not intensified, it is based on the measurement of fewer ground plots than the 1985 inventory. In the 1998 inventory, only a 50-percent systematic sample of the 1985 ground plots was used because of the lower sampling intensity. New plots were established only to replace 1985 plots that could not be remeasured. These new plots were established as near as possible to the original plot. The growth model used in the Illinois survey design was the Central States Stand and Tree Evaluation and Modeling System (STEMS) (Miner *et al.* 1988). Because of the remeasurement nature of the 1998 inventory, procedures for both the 1985 and 1998 inventories are discussed.

PHASE 1 STRATIFICATION

1985 Photo Plot Sampling of Aerial Photographs

In the 1985 inventory, the aerial photographs were assembled into township mosaics, and a systematic grid of 121 one-acre photo plots (each plot representing approximately 190.4 acres) was overlaid on each township mosaic. Each of these photo plots was examined by aerial photo interpretation specialists and classified stereoscopically based on land use, forest type, and stand-size density. A total of 184,815 photo plots formed the basis for the 1985 stratification. From these photo plots, a systematic sample of 10,847 plots were selected as ground plots and further examined by survey crews to verify the classification and to take further measurements. Of the ground plots, 1,209 plots were on forest land. These 1985 ground plots formed the basis for the remeasured ground plots in the 1998 inventory.

1998 Computer-Assisted Classification of Satellite Images

Between inventories, FIA changed its phase 1 methods. Current inventories are based on a computer-assisted classification of Landsat Thematic Mapper satellite imagery. Image classification was conducted by Illinois State University as part of the Gap Analysis Program (GAP). The purpose of GAP (a nationwide multi-agency cooperative program) is to provide broad geographic information on the status of ordinary species and their habitats. FIA used the GAP classifications to form two initial strata, forest and nonforest strata. Pixels that were within 60 m (2 pixel width) of a forest/nonforest edge formed two additional strata—forest/nonforest and nonforest/forest. Forest pixels within 2 pixels of a nonforest pixel (in any direction) were classified forest/nonforest, and nonforest pixels within 2 pixels of a forest pixel were classified nonforest/forest. An overlay of all national forest land ownership was used to identify all lands owned by the Shawnee National Forest. The national forest lands were treated as a single stratum. In the rest of Illinois, stratification and estimation were conducted at the county or county group level. Final estimation of area by strata for the Shawnee National Forest was based on 1,335,799 pixels.

In the 1985 inventory, the stratification was completed by interpretation of the photo plots. The move to GAP satellite imagery changed FIA's phase 1 sample from being based on one photo plot every 190.4 acres to a sample based on a classified pixel every 0.22 acres. The increased intensity of the phase 1 sample greatly improved estimates of the area within each stratum, particularly at the county level. Thus, the stratification used in the 1998 inventory was based on 179.7 million pixels rather than the classification of 184,815 photo plots. Also, because classification was conducted using a computer-assisted algorithm across the entire State, biases in the photo plot sampling method that resulted from differences in photo quality, age of photography, and experience of the photo interpreter were eliminated, and classification was consistent across the entire State.

PHASE 2 GROUND PLOT MEASUREMENTS

1985 Plot Design

In 1985, plots classified as timberland were measured. Each ground plot consisted of a cluster of 10 subplots covering approximately 1 acre. At each subplot, trees 5.0 inches or more in d.b.h. were sampled on a 37.5 basal area factor (baf) variable-radius plot, and trees less than 5.0 inches d.b.h. were sampled on a 1/300-acre fixed-radius plot. The arrangement of the 10 subplots within the plot was adjusted if they were located in a land use that was different from subplot 1. Under the estimation procedures used in this inventory, the entire plot measurement represented a single land classification. Thus, if a subplot was located outside of the land classification for the plot, it was rotated into the land classification. For example, if subplots 1 through 9 were located in a forest land classification and subplot 10 fell in a field, subplot 10 was rotated back into the forest land classification. These plots were established, monumented, and measured as part of the 1985 field inventory. Timberland plots were monumented using metal stakes and permanent paint marks on trees to facilitate the remeasurement of the plot. Plots on other land uses were monumented with a pinprick on the aerial photograph.

1998 Plot Design

In 1998 phase 2, a set of ground plot locations from the 1985 inventory were transferred to the most recent aerial photographs available and overlaid onto the classified satellite imagery. Those 1985 ground plots that definitely were not forest land were given a nonforest ground land-use classification and were not sent to the field for measurement unless the plot had been a forest plot in the 1985 inventory or it was so close to a forest edge that part of the plot could possibly fall in a forest area. If any portion of the plot included forest land (including reserved forest land, unproductive forest land, and timberland), it was either remeasured or modeled. New plots were established only if the original plot could not be relocated, in which case a new plot was established in what was considered the original plot location. Measuring ground plots on all forest lands represented a major change between the 1985 and 1998 inventories. In 1985, plots on reserved and unproductive forest land were not measured.

All ground plots were classified as "undisturbed" or "disturbed" by comparing the 1985 and 1998 aerial photography of the plot location. Disturbance here refers to a major change in forest vegetation caused by factors such as harvesting, land use change, or a major mortality event. All disturbed plots and a one-third sample of the undisturbed plots were remeasured to obtain estimates of current condition and changes since the last inventory. In the remeasurement of the 1985 ground plots, only subplots 1 through 5 were measured. On these five subplots, all trees measured on these plots in 1985 were remeasured or otherwise accounted for, and all new trees that should be tallied using the 1985 plot design were identified and measured. These measurements formed the basis for change estimates between the two inventories such as average annual net growth, mortality, and removals.

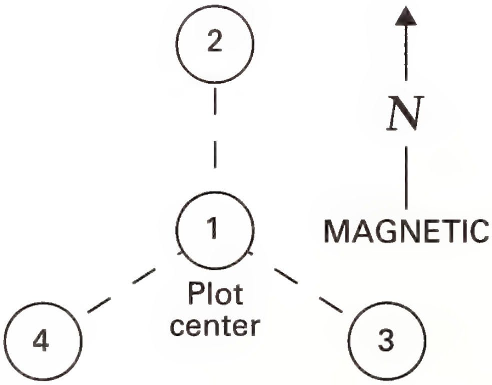
Two-thirds of the ground plots that were timberland at the time of the 1985 inventory and determined to be undisturbed until the 1998 inventory were projected to the current time using STEMS. This procedure gave projected estimates of current volume and growth for these undisturbed plots. The comparison of the projected 1985 ground plots (two-thirds of the total sample) and observed values on the remeasured 1985 ground plots (one-third of the total sample) of the undisturbed forest plots provided local calibration data. The calibration data were used to adjust the projected values of the undisturbed plots that were not remeasured. The adjustment procedure is a modified version of the method described by Smith (1985).

The undisturbed timberland plots that were not remeasured played a crucial role in the survey design. These plots were determined to be undisturbed and had conditions that could be simulated by STEMS. The STEMS growth model was used to "grow" the old plot and tree data to produce an estimate of current data. Thus, these plots were treated as ground plots in the estimation of forest area, number of trees, volume, net growth, and mortality even though they were not revisited. The plot record for each modeled plot was sent to the field for verification of current ownership information.

All old plots classified as disturbed were sent to the field for remeasurement to assess and verify changes since the last inventory. Disturbance refers to any change on a plot that can be detected on the aerial photographs and that the STEMS growth processor cannot predict, such as catastrophic mortality, cutting, regenerating stands, and land use change.

In the 1998 inventory, the new plot design used was based on the Forest Health Monitoring program (FHM) plot design. The new 1998 design was laid over the 1985 design so that estimates of change could be based on the old plot design and estimates of current conditions could be based on the new plot design.

The overall plot layout for the new design consisted of four subplots spaced 120 feet apart in a triangular arrangement (fig. 12). The center of the new plot was located at the same point as the center of the 1985 plot. All trees less than 5 inches d.b.h. were measured on a 6.8-foot-radius (1/300 acre) circular microplot located at the center of each of the four subplots. Trees with diameters 5 inches and larger were measured on a 24-foot-radius (1/24 acre) circular plot. Each subplot was mapped for forest condition. Subplots were not rotated even if they fell into another condition. Factors that would determine a change in condition from subplot one were changes in forest type, stand-size class, land use, ownership, and density. Each condition that occurred anywhere on one of the subplots was identified, described, and mapped if the condition in total met or exceeded 1 acre in size (the 1-acre minimum size for a condition to be identified could include land off-plot). Each condition was assigned a condition number, and condition information was recorded.



From subplot center	120′ to subplot center	Azimuth
1	2	0°
1	3	120°
1	4	240°

Figure 12.—*Standard plot layout for 1998 Illinois inventory.*

Another change in plot measurements that came with the 1998 inventory was the determination of the exact plot location of every ground plot in the inventory. For plots that were visited in the field, this was done using a Global Positioning System (GPS) device at plot center. For the nonforest and undisturbed forest plots that were not visited, plot location was determined by transferring the old plot location from the aerial photography to an unclassified, geo-corrected Landsat TM Image. Both procedures provided an accurate location that was used to link the ground plots to the classified gap data used for stratification.

ESTIMATION

The following sections briefly describe the estimation procedures used to produce the resource tables presented in this and other FIA reports as well as the estimates produced by the table generation programs that are available on CD-ROM or over the Internet. The estimation procedures for computing statistics from this sampling design are somewhat complicated by the fact that not all parameters of interest are observed on every plot. For estimation purposes, the inventory is considered as three different samples: one that uses only the plots that were actually remeasured, one that uses the remeasured and updated plots, and one that uses all plots (remeasured, updated, and new plots).

All estimates from this inventory are based on double sampling for stratification. Cochran (1977) provides a good general presentation of double sampling for stratification, and Loetsch and Haller (1964) provide a more detailed presentation in a forest inventory context. Scott and Bechtold (1995) describe details of the estimation arising from changes in the plot design related to observing more than one condition on a plot.

Current (1998) Area

In double sampling for estimation, each phase 2 sample (ground plot) in a stratum is assigned an area equal to the total estimated area in that stratum divided by the number of phase 2 samples (ground plots) in the stratum. This assigned area is referred to as the expansion factor for the plot and represents the individual plot's contribution to the estimation of current total area. A typical plot in the 1998 inventory has an expansion factor of about 3,650 acres. This amount will vary from plot to plot because of the random variability in the sampling process.

The 1998 plot design was used to estimate all 1998 area estimates such as those presented in tables 1 and 2. When a ground plot was observed to be entirely within a single condition, the plot's contribution towards the estimated total area of that condition was the plot's total expansion factor. When a plot straddled more than one condition, the expansion factor was allocated to the various conditions in direct proportion to the proportion of the plot that condition occupied. For example, a plot with an expansion factor of 3,600 acres that was observed to be 50 percent in oak-hickory timberland, 30 percent in maple-beech timberland, and 20 percent in nonforest land would contribute 1,800 acres to the total estimated area of oak-hickory timberland, 1,080 acres to the total estimated area of maple-beech timberland, and 720 acres to the total estimate of nonforest land. The estimates of current area were based on all ground plots (remeasured, projected, and new) and the four strata defined by the 1998 gap classification.

The average expansion factor for a plot of 3,200 acres can be used to estimate approximately how many plots contribute to a particular area estimate. This is useful to users concerned with the significance of an estimate. For example, table 2 reports there are 170,200 acres of timberland in the oak-hickory type on the Shawnee. Using the 3,200 acres per plot as an average expansion factor, we estimate that about 53 plots would be observed to be oak-hickory timberland. In actuality, oak-hickory timberland was observed on more than 53 plots. Some plots were entirely in the oak-hickory type and others were partially in the oak-hickory type.

Area Change (1985-1998)

Area change estimates were based only on remeasured and projected plots and used the four strata defined by the 1998 gap classification. New plots were not included in the sample because they did not provide observations from two points in time. Area change estimates were based on the 1985 plot design and its remeasurement: the condition found at plot center in both inventories. These estimates thus reflect observations taken at permanent points where land use, forest type, and other condition classifications were determined at two different times (1985 and 1998). The average plot expansion factor for change estimation was 3,700 acres; thus a plot that was observed to be timberland in 1985 and nonforest in 1998 represented 3,700 acres that changed from timberland to nonforest.

Volume

Estimates of volume per acre were made from the trees measured or modeled on all ground plots (remeasured, projected, and new) and the four strata defined by the 1998 gap classification. These estimates came from measurements taken on the new 1998 plot design. Estimates of volume per acre were multiplied by the area estimates to obtain estimates of total volume. Net cubic foot volumes were based on Hahn and Hansen (1991) for use in the Central

States. For the Illinois inventory, the merchantable height equation presented in Hahn and Hansen (1991) was used in conjunction with Stone's equation (see appendix I in Hahn and Hansen 1991) to estimate gross volume. This estimate was then corrected by species for variation in bark and cull volume to yield an estimate of net volume, using the coefficients presented in Hahn and Hansen (1991).

The Forest Service reports all board foot volume in International 1/4-inch rule. In Illinois, the Doyle log rule is commonly used. See table A for a comparison of the two rules (Wenger 1984).

Table A.—*Board-foot volumes and board-foot to cubic-foot ratios for International 1/4-inch and Doyle log rules*

Diameter (inches)	Volume in board feet		Board feet per cubic foot	
	Doyle log rule	International 1/4"	Doyle log rule	International 1/4"
6	4	20	0.92	4.59
8	16	40	2.23	5.59
10	36	65	3.38	6.11
12	64	95	4.32	6.42
14	100	135	5.08	5.85
16	144	180	5.69	7.11
18	196	230	6.22	7.30
20	256	290	6.65	7.53
25	441	460	7.47	7.80
30	676	675	8.06	8.05
35	961	925	8.50	8.18
40	1,296	1,220	8.83	8.32

To determine the equivalent Doyle rule board-foot contents of a log from the International 1/4-inch rule, use table B below. For example, a 12-inch diameter log that is 16 feet long has an International 1/4-inch volume of 95 board feet. To convert to Doyle, multiply 95 by 0.67 to obtain 64 board feet, which is the Doyle equivalent for a 12-inch 16-foot log.

Table B.—*International 1/4-inch rule to Doyle log rule conversion factors*

Diameter of log small end (inches)	Length of log in feet 8	10	12	14	16	18
8	0.53	0.50	0.48	0.40	0.40	0.40
10	0.60	0.63	0.60	0.56	0.55	0.53
12	0.71	0.73	0.69	0.66	0.67	0.65
14	0.77	0.78	0.75	0.76	0.74	0.72
16	0.85	0.82	0.83	0.81	0.80	0.79
18	0.89	0.87	0.86	0.86	0.85	0.83
20	0.95	0.91	0.91	0.90	0.88	0.87
25	1.00	0.99	0.97	0.97	0.96	0.94
30	1.04	1.03	1.02	1.01	1.00	0.99
35	1.07	1.06	1.05	1.04	1.04	1.03
40	1.09	1.08	1.08	1.07	1.06	1.06

Net Growth, Mortality, and Removals

In this report, major components of changes in timber volume (growth, mortality, and removals) are reported for two different time periods. Average annual change is an estimate of the change that occurred between inventories.

Average annual net growth and mortality (1985-1997)

Estimates of average annual net growth and mortality per acre were made from the trees on plots that were measured in 1985 and then remeasured or modeled in 1998. The four strata defined by the 1998 gap classification were used for stratification. All estimates of average annual net growth and mortality came from measurements taken using the 1985 plot design.

On remeasured plots, estimates of average annual net growth and mortality per acre came from the remeasured diameters of trees and from observation of trees that died between inventories, using methods presented by VanDeusen *et al.* (1985). Growth and mortality estimates for old undisturbed plots that were updated were derived in the same manner as remeasured plots. The STEMS growth model was adjusted by Survey Unit to meet local conditions, using data from the undisturbed remeasurement plots. As with volume, total growth and mortality estimates were obtained by multiplying the per acre estimates by area expansion factors.

Average annual removals (1985-1997)

Estimates of average annual removals per acre were made from the trees on plots that were measured in 1985 and then remeasured in 1998. The 1985 photo plot sample was used for stratification. All estimates of average annual removals came from measurements taken using the 1985 plot design. New plots and projected plots were not used to estimate average annual removals. These estimates were obtained from trees measured in the last survey and cut or otherwise removed from the timberland base. Because remeasurement plots were a subset of the total ground plots, and not all remeasurement plots had cutting, average annual removals estimates have greater sampling probability than volume, net growth, and mortality estimates.

TREE AND LOG GRADES

Log and tree grades were based on the classification of external characteristics as indicators of quality. Log grades and or tree grades were taken on every sawtimber-size tree measured on the new 1998 four-point plot. Sawtimber softwood trees were graded for quality and assigned a butt log grade. Sawtimber hardwood trees were graded for quality and assigned a tree grade. The volume yield by log grade or tree grade for this sample was used to distribute the volume of the ungraded trees (those on projected plots) by species group. In previous inventories, sawtimber trees were graded on only a third of sample plots.

Hardwood sawtimber trees were graded according to Hanks (1976). The best 12-foot section of the lowest 16-foot hardwood log was used for grading. Hardwood sawtimber trees that did not meet minimum tree grade specifications for grades 1 through 3 were assigned grade 4 according to Forest Service standard specifications for hardwood construction logs described by Rast *et al.* (1973).

Softwood sawtimber trees were graded according to specifications described by Ostrander and Brisbin (1971). For all softwoods, the first merchantable 16-foot log, or shorter lengths down to 12 feet, was used for grading.

Hardwood Tree Grades for Factory Lumber [a]

Grade factor	Tree grade 1			Tree grade 2		Tree grade 3
Length of grading zone (feet)	Butt 16			Butt 16		Butt 16
Length of grading section [b] (feet)	Best 12			Best 12		Best 12
D.b.h., minimum (inches)	16 [c]			13		11
D.i.b., minimum at top of grading section (inches)	13 [c]	16	20	11 [d]	12	8
Clear cuttings (on the 3 best faces) [e]						
Length, minimum (feet)	7	5	3	3	3	2
Number on face (maximum)	2			2	3	Unlimited
Yield in face length (minimum)	5/6			4/6		3/6
Cull deduction (including crook and sweep, but excluding shake) maximum within grading section (percent)	9			[f]		50

[a] *Hanks (1976).*

[b] *Whenever a 14- or 16-foot section of the butt 16-foot log is better than the best 12-foot section, the grade of the longer section will become the grade of the tree. This longer section, when used, is the basis for determining the grading factors such as diameter and cull deduction.*

[c] *In basswood and ash, d.i.b. at top of grading section must be 12 inches and d.b.h. must be 15 inches.*

[d] *Grade 2 trees can be 10 inches d.i.b. at top of grading section if they otherwise meet surface requirements for small grade 1's.*

[e] *A clear cutting is a portion of a face free of defects, extending the width of the face. A face is one-fourth of the surface of the grading section as divided lengthwise.*

[f] *Fifteen percent crook and sweep or 40 percent total cull deduction are permitted in grade 2 trees, if size and surface of grading section qualify as grade 1. If rot shortens the required clear cuttings to the extent of dropping the butt log to grade 2, do not drop the tree's grade to 3 unless the cull deduction for rot is greater than 40 percent.*

Forest Service Standard Specifications for Hardwood Construction Logs (tie and timber logs) [a, b]

Position in tree	Butts and uppers
Minimum diameter, small end	8 inches
Minimum length without trim	8 feet
Clear cuttings	No requirements
Sweep allowance	1/4 of the diameter at the small end for each 8 feet of length.
Sound surface defects:	
Single knots	Any number, if no one knot has an average diameter above the callus in excess of one-third of the log diameter at point of occurrence.
Whorled knots	Any number, if the sum of knot diameters above the callus does not exceed one-third of the log diameter at point of occurrence.
Holes	Any number, provided none has a diameter over one-third of the log diameter at point of occurrence and none extends more than 3 inches into included timber [c].
Unsound surface defects:	Same requirements as for sound defects if they extend into included timber. No limit if they do notl Logs must e sound internally.

[a] *Rast* et al. *(1973).*

[b] *These specifications are minimum for the class. If, from a group of logs, factory logs are selected first, thus leaving only nonfactory logs from which to select construction logs, then the quality range of the construction logs so selected is limited, and the class may be considered a grade. If selection for construction logs is given first priority, it may be necessary to subdivide the class into grades.*

[c] *Included timber is always square, and dimension is judged from small end.*

Eastern White Pine Saw Log Grade Specifications [a]

Grading factor	Log grade 1	Log grade 2	Log grade 3	Log grade 4
1. Minimum scaling diameter (inches)	14[b]	6	6	6
2. Minimum log length (feet)	10[c]	8	8	8
3. Maximum weevil injury (number)	None	None	2 injuries[d]	No limit
4. Minimum face requirements	Two full length or four 50%[e] length good faces (in addition, log knots on balance of faces shall not exceed size limit of grade 2 logs).	**NO GOOD FACES REQUIRED** Maximum diameter of log knots on three best faces:		Includes all logs not qualifying for No. 3 or better and having at least 1/3 of their gross volume in sound wood suitable for manufacture into standard lumber.
		SOUND RED KNOTS		
		not to exceed 1/6 scaling diameter and 3″ maximum	not to exceed 1/3 scaling diameter and 5″ maximum	
		OVERGROWN/DEAD/BLACK KNOTS		
		not to exceed 1/12 scaling diameter and 1 1/2″ max.	not to exceed 1/6 scaling diameter and 2 1/2″ max.	
5. Maximum sweep or crook (%)	20	30	40	66 2/3
6. Maximum total scaling deduction (%)	50	50	50	66 2/3

After the tentative grade is established from face examination, the grade will be reduced whenever the following defects are evident:

7. Conks, punk knots, and pine borer damage on bark surface.[f]
Degrade one grade if present on one face.

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[a] Ostrander and Brisbin (1971).

[b] 12- and 13-inch logs with four full-length good faces are acceptable.

[c] 8-foot logs with four full-length good faces are acceptable.

[d] 8-foot Number 3 logs limited to one weevil injury.

[e] Minimum 50% length good face must be at least 6 feet.

[f] Factors 7 and 8 are not cumulative (total degrade based on more serious of the two).

No log is to be degraded below grade 4 if net scale is at least one-third of goss scale.

Log Grades for All Other Softwood Logs

Grade 1

1. Trees must be 16 inches in diameter or larger, grading section 12 feet in length or longer, and with deduction for defect not over 30 percent of gross scale.

2. Trees must be at least 75 percent clear on each of three faces.

3. All knots outside clear cutting must be sound and not more than 2-1/2 inches in size.

Grade 2

1. Trees must be 12 inches in diameter or larger, grading section 12 feet in length or longer, and with a net scale after deduction for defect of at least 50 percent of the gross scale deducted for defect.

2. Trees must be at least 50 percent clear on each of three faces or 75 percent clear on two faces.

Grade 3

1. Trees must be 6 inches in diameter or larger, grading section 12 feet in length or longer, and with a net scale after deduction for defect of at least 50 percent of the gross contents of the log.

Note: Diameters are diameter inside bark (d.i.b.) at small end of grading section.
Percent clear refers to percent clear in one continuous section.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters, 2.54 centimeters, or 0.0254 meter.
1 pound = 0.454 kilograms.
1 ton = 0.907 metric tons.

TREE SPECIES GROUPS IN ILLINOIS (LITTLE 1981)

Softwoods	
Eastern redcedar	*Juniperus virginiana*
Tamarack	*Larix laricina*
White spruce	*Picea glauca*
Jack pine	*Pinus banksiana*
Shortleaf pine	*P. echinata*
Red pine	*P. resinosa*
Eastern white pine	*P. strobus*
Scotch pine	*P. sylvestris*
Virginia pine	*P. virginiana*
Baldcypress	*Taxodium distichum*
Hardwoods	
Hard maples[1]	
Black maple	*Acer nigrum*
Sugar maple	*A. saccharum*
Soft maples[2]	
Red maple	*A. rubrum*
Silver maple	*A. saccharinum*
Birches	
Yellow birch[1]	*Betula alleghaniensis*
Gray birch[2]	*B. populifolia*
River birch[2]	*B. nigra*
Paper birch[2]	*B. papyrifera*
Select hickories[1]	
Pecan	*Carya illinoensis*
Shellbark hickory	*C. laciniosa*
Shagbark hickory	*C. ovata*
Mockernut hickory	*C. tomentosa*
Other hickories[1]	
Water hickory	*C. aquatica*
Bitternut hickory	*C. cordiformis*
Pignut hickory	*C. glabra*
American chestnut[2]	*Castanea dentata*
Hackberry[2]	*Celtis occidentalis*
Common persimmon[1]	*Diospyros virginiana*
American beech[1]	*Fagus grandifolia*
Ashes	
White ash[1]	*Fraxinus americana*
Black ash[2]	*F. nigra*
Green ash[1]	*F. pennsylvanica*
Blue ash[1]	*F. quadrangulata*
Butternut[2]	*Juglans cinerea*
Black walnut[1]	*Juglans nigra*
Sweetgum[2]	*Liquidambar styraciflua*
Yellow-poplar[2]	*Liriodendron tulipifera*
Water tupelo[2]	*Nyssa aquatica*

Black tupelo[2]	*N. sylvatica* var. *sylvatica*
Swamp tupelo (Blackgum)[2]	*N. sylvatica* var. *biflora*
Sycamore[2]	*Platanus occidentalis*
Populus[2]	
Balsam poplar	*Populus balsamifera*
Eastern cottonwood	*P. deltoides*
Bigtooth aspen	*P. grandidentata*
Quaking aspen	*P. tremuloides*
Black cherry[2]	*Prunus serotina*
Select white oaks[1]	
White oak	*Quercus alba*
Swamp white oak	*Q. bicolor*
Bur oak	*Q. macrocarpa*
Swamp chestnut oak	*Q. michauxii*
Chinkapin oak	*Q. muehlenbergii*
Other white oaks[1]	
Overcup oak	*Q. lyrata*
Chestnut oak	*Q. prinus*
Post oak	*Q. stellata*
Select red oak[1]	
Cherrybark oak	*Q. falcata* var. *pagodifolia*
Northern red oak	*Q. rubra*
Shumard oak	***Q. shumardii*** var. *shumardii*
Other red oaks[1]	
Scarlet oak	*Q. coccinea*
Northern pin oak	*Q. ellipsoidalis*
Southern red oak	*Q. falcata*
Shingle oak	*Q. imbricarta*
Blackjack oak	*Q. marilandica*
Pin oak	*Q. palustris*
Black oak	*Q. velutina*
Black willow[2]	*Salix nigra*
Sassafras[2]	*Sassafras albidum*
American basswood[2]	*Tilia americana*
Elms	
Winged elm[2]	*Ulmus alata*
American elm[2]	*U. americana*
Siberian elm[2]	*U. pumila*
Slippery elm[2]	*U. rubra*
Rock elm[1]	*U. thomasii*
Other hardwoods	
Boxelder[2]	*Acer negundo*
Ohio buckeye[2]	*Aesculus glabra*
Yellow buckeye[2]	*A. octandra*
European alder[2]	*Alnus glutinosa*
Northern catalpa[2]	*Catalpa speciosa*
Flowering dogwood[1]	*Cornus florida*

Honeylocust[1]	*Gleditsia triacanthos*
Kentucky coffeetree[1]	*Gymnocladus dioicus*
Mulberry[2]	*Morus* spp.
White poplar[2]	*Populus alba*
Black locust[1]	*Robinia pseudoacacia*
Noncommercial species	
Ailanthus	*Ailanthus altissima*
Pawpaw	*Asimina triloba*
American hornbeam	*Carpinus caroliniana*
Eastern redbud	*Cercis canadensis*
Hawthorn	*Crataegus* spp.
Osage-orange	*Maclura pomifera*
Apple	*Malus* spp.
Eastern hophornbeam	*Ostrya virginiana*
Pin cherry	*Prunus pensylvanica*
Wild plum	*Prunus* spp.
Chokecherry	*P. virginiana*
Peachleaf willow	*Salix amygdaloides*
Diamond willow	*S. bebbiana*
American mountain-ash	*Sorbus americana*

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[1] *This species or species group is considered a hard hardwood, with an average specific gravity greater than or equal to 0.50.*

[2] *This species or species group is considered a soft hardwood, with an average specific gravity of less than 0.50.*

DEFINITION OF TERMS

Average annual mortality of growing stock

The average cubic foot volume of sound wood in growing-stock trees that died in one year. Average annual mortality is the average for the years between inventories (1985 to 1997 in this report).

Average annual mortality of sawtimber

The average board foot volume of sound wood in sawtimber trees that died in one year. Average annual mortality is the average for the years between inventories (1985 to 1997 in this report).

Average annual removals from growing stock

The average net growing-stock volume in growing-stock trees removed annually for roundwood forest products, in addition to the volume of logging residues, and the volume of other removals. Average annual removals of growing stock are the average for the years between inventories (1985 to 1997 in this report) and are based on information obtained from remeasurement plots (see Survey procedures in appendix).

Average annual removals from sawtimber

The average net board foot sawtimber volume of live sawtimber trees removed annually for roundwood forest products, in addition to the volume of logging residues, and the volume of other removals. Average annual removals of sawtimber are the average for the years between inventories (1985 to 1997 in this report) and are based on information obtained from remeasurement plots (see survey procedures in appendix).

Average annual net growth of growing stock

The annual change in cubic foot volume of sound wood in live sawtimber and poletimber trees and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes. Average annual net growth of growing stock is the average for the years between inventories (1985 to 1997 in this report).

Average annual net growth of sawtimber

The annual change in the board foot volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes. Average annual net growth of sawtimber is the average for the years between inventories (1985 to 1997 in this report).

Basal area

Tree area, in square feet, of the cross section at breast height of a single tree. When the basal areas of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Biomass

The aboveground volume of all live trees (including bark but excluding foliage) reported in green tons (i.e., green weight). Biomass has four components:

Bole.—Biomass of a tree from 1 foot above the ground to a 4-inch top outside bark.

Tops and limbs.—Total biomass of a tree from a 1-foot stump minus the bole.

1- to 5-inch trees.—Total aboveground biomass of a tree from 1 to 5 inches in diameter at breast height.

Stump.—Biomass of a tree 5 inches d.b.h. and larger from the ground to a height of 1 foot.

Bolts

Roundwood logs of less than 8 feet in length that are converted into shingles, cooperage stock, dimension stock, blocks, blanks, excelsior, and other products. No minimum diameter limits. Does not include logs used for the manufacture of pulp or veneer.

Commercial species

Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hophornbeam, Osage-orange, and redbud.)

Cord

One standard cord is 128 cubic feet of stacked wood, including bark and air space. Cubic feet can be converted to solid wood standard cords by dividing by 79.

Corporate

Lands owned by a private corporation not in the business of operating primary wood-using plants.

County and municipal land

Land owned by counties and local public agencies or municipalities, or land leased to these governmental units for 50 years or more.

Cropland

Land under cultivation within the last 24 months, including cropland harvested, crop failures, cultivated summer fallow, idle cropland used only for pasture, orchards, active Christmas tree plantations indicated by annual shearing, nurseries, and land in soil improvement crops, but excluding land cultivated in developing improved pasture.

Cull

Portions of a tree that are unusable for industrial wood products because of rot, missing or dead material, form, or other defect.

Current annual net growth of growing stock

The annual change in volume of sound wood in live sawtimber and poletimber trees and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes, reported for a single year (1997 in this report). Current net growth is based on an estimate of the current annual increment of each growing-stock tree in the inventory.

Current annual net growth of sawtimber

The annual change in the volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes, reported for a single year (1997 in this report). Current net growth is based on an estimate of the current annual increment of each growing-stock tree in the inventory.

Current annual removals from growing stock

The current net growing-stock volume in growing-stock trees removed annually for roundwood forest products, in addition to the volume of logging residues, and the volume of other removals. Current annual removals of growing stock are reported for a single year (1997 in this report); they are based on a survey of primary wood processing mills to determine removals for products and on information from remeasurement plots (see survey procedures in appendix) to determine removals due to land use change.

Current annual removals from sawtimber

The current net board foot sawtimber volume of live sawtimber trees removed annually for roundwood forest products, in addition to the volume of logging residues, and the volume of other removals. Current annual removals of sawtimber are reported for a single year (1997 in this report); they are based on a survey of primary wood processing mills to determine removals for products and on information from remeasurement plots (see survey procedures in appendix) to determine removals due to land use change.

Diameter class

A classification of trees based on diameter outside bark, measured at breast height 4.5 feet above the ground. (Note: d.b.h. is the common abbreviation for diameter at breast height.) Two-inch diameter classes are commonly used in forest inventory and analysis, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h.

Diameter at breast height (d.b.h.)

The outside bark diameter at 4.5 feet (1.37 m) above the forest floor on the uphill side of the tree. For determining breast height, the forest floor includes the duff layer that may be present but does not include unincorporated woody debris that may rise above the ground line.

Forest industry land

Land owned by companies or individuals operating primary wood-using plants.

Forest land

Land at least 10 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparing specified standards with basal area and/or number of trees, age or size, and spacing.) The minimum area for classification of forest land is 1 acre. Roadside, streamside, and windbreak strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails or clearings in forest areas shall be classed as forest if less than 120 feet wide. Water bodies (rivers, streams, or lakes) less than 30 feet in width shall be classed as forest. Water bodies more than 30 feet in width are classified as water (see definitions for Tree, Land, Timberland, Reserved forest land, Other forest land, Stocking, and Water).

Forest type

A classification of forest land based on the species forming a plurality of live tree stocking. The associated species for each forest type are based on net volume of growing stock by species group. Major forest types are:

White pine.—Forests in which white pine makes up a plurality of the stocking. Species commonly associated with the white pine forest type in Illinois include red pine, yellow-poplar, Virginia pine, and shortleaf pine.

Shortleaf-Virginia pine.—Forests in which shortleaf and Virginia pine, singly or in combination, make up a plurality of the stocking. Species commonly associated with the shortleaf-Virginia pine forest type in Illinois include yellow-poplar, hard maple, sycamore, and black cherry.

Eastern redcedar.—Forests in which eastern redcedar makes up a plurality of the stocking. Species commonly associated with the eastern redcedar forest type in Illinois include yellow-poplar, red oaks, and black cherry.

Eastern redcedar-hardwoods.—Forests in which hardwoods make up a plurality of the stocking but in which eastern redcedar makes up between 25 and 50 percent of the stocking. Hardwood species commonly associated with the hardwood portion of this forest type in Illinois include ash, hickories, hard maple, white oaks, red oaks, and yellow-poplar.

Oak-pine.—Forests in which oaks and hickories, singly or in combination, make up a plurality of the stocking but where pines or eastern redcedar makes up 25 to 50 percent of the stocking. Species commonly associated with the oak-pine forest type in Illinois include yellow-poplar, cottonwood, river birch, and sycamore.

Oak-hickory.—Forests in which upland oaks and hickories, singly or in combination, make up a plurality of the stocking. Species commonly associated with the oak-hickory forest type in Illinois include yellow-poplar, ash, black cherry, cottonwood, and black walnut.

Oak-gum-cypress.—Forests in which tupelo, blackgum, sweetgum, oaks, or cypress, singly or in combination, make up a plurality of the stocking. Species commonly associated with the oak-gum-cypress forest type in Illinois include yellow-poplar, cottonwood, ash, and sycamore.

Elm-ash-cottonwood.—Forests in which lowland elm, ash, red maple, silver maple, and cottonwood, singly or in combination, make up a plurality of the stocking. Species commonly associated with the elm-ash-cottonwood forest type in Illinois include sycamore, yellow-poplar, red oak, and black walnut.

Maple-beech.—Forests in which hard maple, beech, American elm, and red maple, singly or in combination, make up a plurality of the stocking. Species commonly associated with the maple-beech forest type in Illinois include white oaks, red oaks, hickories, yellow-poplar, and ash.

Cherry-ash-yellow poplar.—Forests in which black cherry, white ash, and yellow-poplar, singly or in combination, make up a plurality of the stocking. Species commonly associated with the cherry-ash-yellow poplar forest type in Illinois include black walnut, American elm, white oak, and hard maples.

Aspen-birch.—Forests in which quaking aspen, bigtooth aspen, and paper birch, singly or in combination, make up a plurality of the stocking. Species commonly associated with the aspen-birch forest type in Illinois include red oaks and yellow-poplar.

Growing-stock tree

A live tree of commercial species that meets specified standards of size, quality, and merchantability. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume

Net volume in cubic feet of growing-stock trees 5.0 inches d.b.h. and over, from 1 foot above the ground to a minimum 4.0-inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs.

Hard hardwoods

Hardwood species with an average specific gravity greater than 0.50 such as oaks, hard maple, hickories, and ash.

Hardwoods

Dicotyledonous trees, usually broad-leaved and deciduous. (See definitions for Soft hardwoods and Hard hardwoods.)

Improved pasture

Land currently improved for grazing by cultivating, seeding, irrigating, or clearing trees or brush and less than 10 percent stocked with trees.

Industrial wood

All roundwood products except residential fuelwood.

Land

(a) Bureau of the Census.—Dry land and land temporarily or partly covered by water such as marshes, swamps, and river flood plains, (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than one-eighth of a statute mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

(b) Forest Inventory and Analysis.—The same as the Bureau of the Census, except minimum width of streams, etc., is 120 feet and minimum size of lakes, etc., is 1 acre.

Live trees

Growing-stock, rough, and rotten trees 1.0 inch d.b.h. and larger.

Log grade

A log classification based on external characteristics as indicators of quality or value. Log grade was assigned to a sample of softwood sawtimber trees throughout the state during the 1998 inventory. Also see tree grade in definitions. (See appendix for specific grading factors used.)

Logging residue

The unused portions of cut trees, plus unused trees killed by logging.

Marsh

Nonforest land that characteristically supports low, generally herbaceous or shrubby vegetation, and that is intermittently covered with water.

Merchantable

Refers to a pulpwood or saw log section that meets pulpwood or saw log specifications, respectively.

Miscellaneous Federal land

Federal land other than national forest and land administered by the Bureau of Land Management or Bureau of Indian Affairs.

National forest land

Federal land that has been legally designated as national forest or purchase units, and other land administered by the USDA Forest Service.

Net volume

Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

Noncommercial species

Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial wood products.

Nonforest land

Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, active Christmas tree plantations as indicated by annual shearing, orchards, nurseries, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land.) If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide and more than 1 acre in area to qualify as nonforest land.

Nonforest land without trees.—Nonforest land with no live trees present.

Nonforest land with trees.—Nonforest land with one or more trees per acre at least 5 inches d.b.h.

Nonstocked land

Timberland less than 10 percent stocked with all live trees.

Other forest land

Forest land not capable of producing 20 cubic feet per acre per year of industrial wood crops under natural conditions and not associated with urban or rural development. Many of these sites contain tree species that are not currently used for industrial wood production or trees of poor form, small size, or inferior quality that are unfit for most industrial products. Unproductivity may be the result of adverse site conditions such as sterile soil, dry climate, poor drainage, high elevation, and rockiness. This land is not withdrawn from timber use.

Other removals

Growing-stock trees removed but not used for products, or trees left standing but "removed" from the timberland classification by land use change. Examples are removals from cultural operations such as timber stand improvement work and land clearing, and the standing volume on land classified originally as timberland but later designated as reserved from timber harvesting (such as a newly established State Park).

Ownership size class

The amount of timberland owned by one owner, regardless of the number of parcels.

Pasture

Land presently used for grazing or under cultivation to develop grazing.

Physiographic class

A measure of soil and water conditions that affect tree growth on a site. The physiographic classes are:

Xeric sites.—Very dry soils where excessive drainage seriously limits both growth and species occurrence. Example: eastern redcedar barrens.

Xeromesic sites.—Moderately dry soils where excessive drainage limits growth and species occurrence to some extent. Example: dry oak ridge.

Mesic sites.—Deep, well-drained soils. Growth and species occurrence are limited only by climate. Example: well-drained terraces of loamy soil.

Hydromesic sites.—Moderately wet soils where insufficient drainage or infrequent flooding limits growth and species occurrence to some extent. Example: moderately drained bottomland hardwood sites.

Hydric sites.—Very wet sites where excess water seriously limits both growth and species occurrence. Example: frequently flooded river bottoms.

Plant byproducts

Plant residues used for products such as mulch, pulp chips, and fuelwood.

Plantation

An artificially reforested area sufficiently productive to qualify as timberland. The planted species is not necessarily predominant. Christmas tree plantations, which are considered cropland, are not included.

Plant residues

Wood and bark materials generated at manufacturing plants during production of other products.

Poletimber stand

(See Stand-size class.)

Poletimber tree

A live tree of commercial species at least 5.0 inches d.b.h., but smaller than sawtimber size.

Potential productivity class

A classification of forest land in terms of inherent capacity to grow crops of industrial wood. The class identifies the potential growth in merchantable cubic feet/acre/year at culmination of mean annual increment of fully stocked natural stands.

Private individual land

Privately owned land not owned by forest industry. This class includes the formerly used farmer and miscellaneous private classes.

Reserved forest land

Forest land withdrawn from timber use through statute, administrative regulation, or designation. Note: Historically, Christmas tree plantations were classified as reserved forest land. However, Christmas tree plantations are now classified as cropland.

Rotten tree

Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough tree

(a) Live trees of commercial species that do not contain at least one merchantable 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of roughness or poor form, and

(b) all live trees of noncommercial species.

Roundwood products

Logs, bolts, or other round sections (including chips from roundwood) cut from trees for industrial or consumer uses. (Note: Includes saw logs, veneer logs, and bolts; cooperage logs and bolts; pulpwood; fuelwood; pilings; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

Salvable dead tree

A standing or down dead tree considered merchantable by regional standards.

Sapling

A live tree 1.0 to 5.0 inches d.b.h.

Sapling-seedling stand

(See Stand-size class.)

Saw log

A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight, and with a minimum diameter outside bark (d.o.b.) for softwoods of 7.0 inches (9.0 inches for hardwoods) or other combinations of size and defect specified by regional standards.

Saw log portion

That part of the bole of sawtimber trees between the stump and the saw log top.

Saw log top

The point on the bole of sawtimber trees above which a saw log cannot be produced. The minimum saw log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

Sawtimber stand

(See Stand-size class.)

Sawtimber tree

A live tree of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. Hardwoods must be at least 11.0 inches d.b.h.

Sawtimber volume

Net volume of the saw log portion of live sawtimber in board feet, International 1/4-inch rule (unless specified otherwise), from stump to a minimum 7.0 inches top d.o.b. for softwoods and a minimum 9.0 inches top d.o.b. for hardwoods.

Seedling

A live tree less than 1.0 inch d.b.h. that is expected to survive. Only softwood seedlings more than 6 inches tall and hardwood seedlings more than 1 foot tall are counted.

Short-log (rough tree)

A sawtimber-size tree of commercial species that contains at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Shrub

A woody, perennial plant differing from a perennial herb in its persistent and woody stem(s) and less definitely from a tree in its lower stature and/or the general absence of a well-defined main stem. For this report, shrubs were separated somewhat arbitrarily into tall and low shrubs as follows:

Tall shrubs.—Normally taller than 1.6 to 3.2 feet (0.5 to 1.0 m).

Low shrubs.—Normally shorter than 1.6 to 3.2 feet (0.5 to 1.0 m). (Woody perennial vines, such as grape, were included with low shrubs.)

Shrub and tree seedling biomass

The total aboveground weight of trees less than 1.0 inch in diameter and all shrubs.

Site index

An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Soft hardwoods

Hardwood species with an average specific gravity less than 0.50, such as cottonwood, red maple, basswood, and willow.

Softwoods

Coniferous trees, usually evergreen, having needles or scale-like leaves.

Stand

A group of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Stand-age class

A classification based on age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Stand-size class

A classification of stocked (see Stocking) forest land based on the size class of live trees on the area; that is, sawtimber, poletimber, or seedlings and saplings.

Sawtimber stands.—Stands with half or more of live tree stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands with half or more of live tree stocking in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands with more than half of the live tree stocking in saplings and/or seedlings.

State land

Land owned by the State of Illinois or leased to it for 50 years or more.

Stocking

The degree of occupancy of land by live trees, measured by basal area and/or the number of trees in a stand by size or age and spacing, compared to the basal area and/or number of trees required to fully use the growth potential of the land; that is, the stocking standard. A stocking percent of 100 indicates full use of the site and is equivalent to 80 square feet of basal area per acre in trees 5.0 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stands are grouped into the following stocking classes:

Overstocked stands.—Stands in which stocking of live trees is 100 percent or more.

Fully stocked stands.—Stands in which stocking of live trees is from 60 to 99 percent.

Medium stocked stands.—Stands in which stocking of live trees is from 35 to 59 percent.

Poorly stocked stands.—Stands in which stocking of live trees is from 10 to 34 percent.

Nonstocked areas.—Timberland on which stocking of live trees is less than 10 percent.

Timber products output

All timber products cut from roundwood and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Timberland

Forest land that is producing, or is capable of producing, more than 20 cubic feet per acre per year of industrial wood crops under natural conditions, that is not withdrawn from timber use, and that is not associated with urban or rural development. Currently inaccessible and inoperable areas are included. (Timberland was formerly called commercial forest land.)

Tree

A woody plant usually having one or more erect perennial stems, a stem diameter at breast height of at least 3 inches, a more or less definitely formed crown of foliage, and a height of at least 13 feet at maturity.

Tree biomass

The total aboveground weight (including the bark but excluding the foliage) of all trees from 1 to 5 inches in d.b.h., and the total aboveground weight (including the bark but excluding the foliage) from a 1-foot stump for trees more than 5 inches in diameter.

Tree grade

A classification of the lower 16 feet of the bole of standing trees based on external characteristics as indicators of the quality and quantity of lumber that could be produced from the tree. Tree grade was assigned to a sample of hardwood sawtimber trees during the 1998 inventory. Also see log grade in the definitions. (See appendix for specific grading factors used.)

Tree size class

A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings, and seedlings.

Upper stem portion

That part of the bole of sawtimber trees above the saw log top to a minimum top diameter of 4.0 inches d.o.b., or to the point where the central stem breaks into limbs.

Urban and other areas

Areas within the legal boundaries of cities and towns; suburban areas developed for residential, industrial, or recreational purposes; school yards; cemeteries; roads; railroads; airports; beaches; powerlines and other rights-of-way; or other nonforest land not included in any other specified land use class.

Urban forest land

Land that would otherwise meet the criteria for timberland, but that is in an urban-suburban area surrounded by commercial, industrial, or residential development and not likely to be managed for the production of industrial wood products on a continuing basis. Wood removed would be for land clearing, fuelwood, or esthetic purposes. Such forest land may be associated with industrial, commercial, residential subdivision, industrial parks, golf course perimeters, airport buffer strips, and public urban parks that qualify as forest land.

Water

(a) ***Bureau of the Census***.—Permanent inland water surfaces, such as lakes, reservoirs, and ponds at least 40 acres in area; and streams, sloughs, estuaries, and canals at least one-eighth of a statute mile wide.

(b) ***Noncensus***.—Permanent inland water surfaces, such as lakes, reservoirs, and ponds from 1 to 39.9 acres in area; and streams, sloughs, estuaries, and canals from 120 feet to one-eighth of a statute mile wide.

Wooded pasture

Improved pasture with more than 16.7 percent stocking in live trees, but less than 25 percent stocking in growing-stock trees. Area is currently improved for grazing or there is other evidence of grazing.

Wooded strip

An acre or more of natural continuous forest land that would otherwise meet survey standards for timberland except that it is less than 120 feet wide.

LITERATURE CITED

Cochran, W.G. 1977. Sampling techniques. New York, NY: John Wiley and Sons, Inc. 413 p.

Hahn, J.T.; Hansen, M.H. 1991. Cubic and board feet volume models for the Central States. Northern Journal of Applied Forestry. 8(2): 47-57.

Hanks, L.F. 1976. Hardwood tree grades for factory lumber. Res. Pap. NE-333. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 81 p.

Iverson, L.R.; Oliver, R.L.; Tucker, D.P.; Riser, P.G.; Burnett, C.D.; Rayburn, R.G. 1989. The forest resources of Illinois: an atlas and analysis of spatial and temporal trends. Spec. Publ. 11. [Chicago], IL: Illinois Natural History Survey. 181 p.

Little, E.L. 1981. Checklist of native and naturalized trees of the United States. Agric. Handb. 541. Washington, DC: U.S. Department of Agriculture, Forest Service. 385 p.

Loetsch, F.; Haller, K.E. 1964. Forest inventory, volume 1, statistics of forest inventory and information from aerial photographs. BLV Verlagsgesellschaft Munch Basle Vienna. 436 p.

Miles, P.D.; Brand, G.J.; Alerich, C.L.; Bednar, L.F.; Woudenberg, S.W.; Glover, J.F.; Ezzell, E.N. 2001. The Forest Inventory and Analysis database: database description and users manual version 1.0. Gen. Tech. Rep. NC-218. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 130 p.

Miner, C.L.; Walters, N.R.; Belli, M.L. 1988. Guide to the TWIGS program for the north central United States. Gen. Tech. Rep. NC-125. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 105 p.

Ostrander, M.D.; Brisbin, R.L. 1971. Sawlog grades for eastern white pine. Res. Pap. NE-205. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 24 p.

Rast, E.D.; Sonderman, D.L.; Gammon, G.L. 1973. A guide to hardwood log grading. Gen. Tech. Rep. NE-1. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 31 p.

Schmidt, Thomas L.; Hansen, Mark H.; Solomakos, James A. 2000. Illinois' forests in 1998. Resour. Bull. NC-198. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 133 p.

Scott, C.T.; Bechtold, W.A. 1995. Techniques and computations for mapping clusters that straddle stand boundaries. For. Sci. Monogr. 31. Supplement to Forest Science. 41(3): 46-61.

Smith, W.B. 1985. Adjusting the STEMS regional growth models to improve local predictions. Res. Note NC-297. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 5 p.

U.S. Department of Agriculture, Forest Service. 2002. Shawnee National Forest, forest facts. Shawnee National Forest Web site: http://www.fs.fed.us/r9/shawnee/facts.html

VanDeusen, P.C.; Dell, T.R.; Thomas, C.E. 1985. Volume growth estimation from permanent horizontal points. Forest Science. 32: 415-422.

Wenger, K.F. 1984. Forestry handbook. New York, NY: John Wiley and Sons. 1,335 p.

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TABLES

Table 1. -- *Area of land by county and major land-use class, Shawnee National Forest, Illinois, 1998*

(In thousand acres)

County	Total land area[1]	Forest land				Other land
		Total forest	Timberland	Reserved forest land	Other forest land	
Alexander	26.1	26.1	26.1	- -	- -	- -
Gallatin	11.3	11.3	11.3	- -	- -	- -
Hardin	27.5	27.5	27.5	- -	- -	- -
Jackson	47.3	47.3	47.3	- -	- -	- -
Johnson	18.2	15.3	15.3	- -	- -	2.9
Massac	2.7	2.7	2.7	- -	- -	- -
Pope	91.3	91.3	83.7	7.5	- -	- -
Saline	14.4	14.4	10.5	3.9	- -	- -
Union	34.5	34.4	24.9	9.4	- -	0.2
All counties	273.2	270.2	249.3	20.9	- -	3.0

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the area rounds to less than 1 thousand acres. Columns and rows may not add to their totals due to rounding.

[1] From U.S. Bureau of the Census, 1990.

Table 2. -- *Area of timberland by forest type group/local type and stand-size class, Shawnee National Forest, Illinois, 1998*

(In thousand acres)

Forest type group and local type	All stands	Stand-size class			
		Sawtimber	Poletimber	Sapling-seedling	Non-stocked
White-red-jack pine					
White pine	2.2	2.2	--	--	--
Total	2.2	2.2	--	--	--
Loblolly-shortleaf pine					
Shortleaf-Virginia pine	12.6	10.3	2.3	--	--
Total	12.6	10.3	2.3	--	--
Oak-pine					
Eastern redcedar	2.5	--	--	2.5	--
Eastern redcedar-hardwood	3.8	1.3	2.5	--	--
Oak-pine	7.5	4.6	2.9	--	--
Total	13.8	5.9	5.4	2.5	--
Oak-hickory					
Oak-hickory	170.2	121.6	44.3	4.4	--
Total	170.2	121.6	44.3	4.4	--
Oak-gum-cypress					
Oak-gum-cypress	3.1	--	3.1	--	--
Total	3.1	--	3.1	--	--
Elm-ash-cottonwood					
Elm-ash-cottonwood	7.5	5.3	2.2	--	--
Total	7.5	5.3	2.2	--	--
Maple-beech-birch					
Maple-beech	32.4	28.0	4.4	--	--
Cherry-ash-yellow poplar	7.5	4.8	2.1	0.6	--
Total	39.9	32.8	6.4	0.6	--
Nonstocked					
Other	--	--	--	--	--
Total	0.0	--	--	--	--
Nonstocked	--	--	--	--	--
All types	249.3	178.1	63.7	7.5	--

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the area rounds to less than 1 thousand acres. Columns and rows may not add to their totals due to rounding.

Table 3. -- *Number of all live trees on timberland by species group and diameter class, Shawnee National Forest, Illinois, 1998*

(In thousand trees)

	All	Diameter class (inches at breast height)											
Species group	classes	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods													
White pine	1,135	90	90	361	291	133	131	26	13	- -	- -	- -	- -
Loblolly pine	148	- -	- -	29	15	29	29	15	- -	- -	30	- -	- -
Shortleaf pine	5,236	607	450	1,064	1,282	1,045	440	264	57	14	13	- -	- -
Eastern redcedar	4,440	2,812	942	442	119	81	29	15	- -	- -	- -	- -	- -
Total softwoods	10,958	3,509	1,482	1,896	1,707	1,288	630	320	70	14	43	- -	- -
Hardwoods													
Select white oak	8,120	2,071	1,487	923	718	786	402	558	510	249	155	245	15
Other white oak	1,795	61	289	191	410	223	224	136	113	40	42	67	- -
Select red oak	2,013	540	270	195	138	60	192	191	118	75	139	96	- -
Other red oak	5,923	2,757	409	435	448	303	350	293	291	273	143	220	- -
Select hickory	4,703	948	1,530	733	604	371	204	175	91	34	13	- -	- -
Other hickory	6,915	2,677	1,067	889	664	638	490	276	126	62	13	14	- -
Beech	2,084	1,442	263	39	52	38	51	90	52	19	- -	38	- -
Hard maple	18,098	10,902	4,373	1,579	479	226	180	157	107	68	13	15	- -
Soft maple	2,072	1,070	585	188	43	34	43	64	30	- -	- -	15	- -
Elm	20,585	15,334	3,168	1,215	470	127	134	50	29	14	30	14	- -
White & green ash	8,521	6,323	1,007	471	265	168	141	74	15	57	- -	- -	- -
Sycamore	55	- -	- -	14	- -	13	- -	13	- -	- -	- -	15	- -
Willow	39	- -	- -	13	26	- -	- -	- -	- -	- -	- -	- -	- -
Hackberry	971	863	- -	42	26	26	14	- -	- -	- -	- -	- -	- -
Balsam poplar	15	- -	- -	15	- -	- -	- -	- -	- -	- -	- -	- -	- -
River birch	59	- -	- -	15	44	- -	- -	- -	- -	- -	- -	- -	- -
Sweetgum	1,882	405	135	496	423	182	143	70	15	13	- -	- -	- -
Tupelo	4,186	2,893	877	195	90	42	44	30	- -	- -	- -	- -	15
Black cherry	1,133	677	135	166	99	28	28	- -	- -	- -	- -	- -	- -
Black walnut	445	218	- -	51	49	72	28	13	- -	- -	- -	14	- -
Yellow-poplar	3,842	2,153	270	366	359	176	138	125	30	112	28	57	28
Other hardwoods	35,178	26,808	5,467	1,795	656	372	54	14	13	- -	- -	- -	- -
Total hardwoods	128,634	78,143	21,332	10,025	6,063	3,884	2,859	2,328	1,540	1,016	575	810	58
Noncommercial species	11,791	10,373	1,215	177	26	- -	- -	- -	- -	- -	- -	- -	- -
All species	151,384	92,025	24,029	12,099	7,796	5,172	3,489	2,648	1,610	1,030	618	810	58

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the number of trees rounds to less than 1 thousand trees. Columns and rows may not add to their totals due to rounding.

Table 4. -- *Number of growing-stock trees on timberland by species group and diameter class, Shawnee National Forest, Illinois, 1998*

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods													
White pine	1,135	90	90	361	291	133	131	26	13	- -	- -	- -	- -
Loblolly pine	148	- -	- -	29	15	29	29	15	- -	- -	30	- -	- -
Shortleaf pine	5,221	607	450	1,050	1,282	1,045	440	264	57	14	13	- -	- -
Eastern redcedar	4,380	2,812	942	397	119	66	29	15	- -	- -	- -	- -	- -
Total softwoods	10,884	3,509	1,482	1,837	1,707	1,272	630	320	70	14	43	- -	- -
Hardwoods													
Select white oak	7,751	1,936	1,427	910	688	757	375	511	484	249	155	245	15
Other white oak	1,678	61	289	161	395	208	207	124	98	40	29	67	- -
Select red oak	1,816	540	135	182	138	60	192	174	118	75	122	81	- -
Other red oak	5,867	2,757	409	420	434	303	335	293	291	273	143	209	- -
Select hickory	4,179	813	1,260	703	575	341	189	160	91	34	13	- -	- -
Other hickory	6,619	2,542	1,067	844	604	624	476	262	113	62	13	14	- -
Beech	2,019	1,442	263	13	52	38	32	71	52	19	- -	38	- -
Hard maple	17,176	10,211	4,373	1,460	452	213	152	125	107	68	- -	15	- -
Soft maple	1,847	935	585	146	43	34	43	45	15	- -	- -	- -	- -
Elm	19,027	14,471	2,718	1,055	398	127	121	50	29	14	30	14	- -
White & green ash	8,073	6,188	1,007	277	202	139	126	61	15	57	- -	- -	- -
Sycamore	55	- -	- -	14	- -	13	- -	13	- -	- -	- -	15	- -
Willow	39	- -	- -	13	26	- -	- -	- -	- -	- -	- -	- -	- -
Hackberry	930	863	- -	14	26	13	14	- -	- -	- -	- -	- -	- -
River birch	30	- -	- -	- -	30	- -	- -	- -	- -	- -	- -	- -	- -
Sweetgum	1,882	405	135	496	423	182	143	70	15	13	- -	- -	- -
Tupelo	4,126	2,893	877	165	90	27	44	15	- -	- -	- -	- -	15
Black cherry	423	227	- -	100	70	13	13	- -	- -	- -	- -	- -	- -
Black walnut	398	218	- -	51	30	57	15	13	- -	- -	- -	14	- -
Yellow-poplar	3,842	2,153	270	366	359	176	138	125	30	112	28	57	28
Other hardwoods	31,622	25,706	3,980	1,194	444	257	40	- -	- -	- -	- -	- -	- -
Total hardwoods	119,399	74,362	18,795	8,582	5,480	3,581	2,654	2,112	1,457	1,016	533	768	58
All species	130,283	77,871	20,277	10,420	7,187	4,854	3,283	2,432	1,527	1,030	576	768	58

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the number of trees rounds to less than 1 thousand trees. Columns and rows may not add to their totals due to rounding.

Table 5. -- *Net volume of all live trees*[1] *greater than 5 inches in diameter at breast height on timberland by species group and diameter class, Shwanee National Forest, Illinois, 1998*

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods											
White pine	7,637	866	1,617	1,393	2,373	763	625	--	--	--	--
Loblolly pine	3,164	57	102	280	446	393	--	--	1,886	--	--
Shortleaf pine	36,616	2,751	6,942	10,329	7,100	6,306	1,722	622	844	--	--
Eastern redcedar	2,829	920	579	644	368	318	--	--	--	--	--
Total softwoods	50,246	4,595	9,240	12,645	10,287	7,779	2,347	622	2,730	--	--
Hardwoods											
Select white oak	85,021	2,311	3,421	7,049	5,933	11,804	15,023	10,146	8,058	19,244	2,033
Other white oak	20,510	400	1,987	1,785	2,805	2,737	3,191	1,632	1,882	4,091	--
Select red oak	32,928	536	745	490	3,019	4,120	3,735	3,317	7,916	9,049	--
Other red oak	63,248	966	2,303	2,759	5,079	6,565	9,086	11,417	8,015	17,058	--
Select hickory	21,359	1,749	3,034	3,596	3,037	4,314	3,323	1,613	693	--	--
Other hickory	36,148	1,879	3,332	6,276	8,026	7,117	4,573	2,985	895	1,065	--
Beech	9,426	107	236	369	863	2,141	1,822	871	--	3,016	--
Hard maple	24,561	3,993	2,636	2,305	2,979	3,733	3,976	3,349	501	1,089	--
Soft maple	4,953	489	228	312	595	1,440	873	--	--	1,017	--
Elm	13,317	2,398	2,130	1,057	1,827	1,108	929	613	1,758	1,498	--
White & green ash	10,413	980	1,514	1,495	1,963	1,660	560	2,240	--	--	--
Sycamore	1,915	46	--	173	--	375	--	--	--	1,321	--
Willow	250	50	200	--	--	--	--	--	--	--	--
Hackberry	593	64	105	238	186	--	--	--	--	--	--
River birch	231	32	199	--	--	--	--	--	--	--	--
Sweetgum	9,868	1,076	2,077	1,667	2,144	1,680	574	650	--	--	--
Tupelo	5,533	396	439	350	664	500	--	--	--	--	3,185
Black cherry	1,512	371	544	229	368	--	--	--	--	--	--
Black walnut	2,736	148	180	577	391	254	--	--	--	1,187	--
Yellow-poplar	32,959	959	2,220	1,934	2,574	3,700	1,273	6,081	2,340	5,049	6,831
Other hardwoods	10,214	3,248	2,781	3,018	640	163	364	--	--	--	--
Total hardwoods	387,694	22,198	30,308	35,678	43,092	53,413	49,302	44,914	32,059	64,682	12,049
Noncommercial species	386	291	95	--	--	--	--	--	--	--	--
All species	438,326	26,793	39,548	48,323	53,379	61,192	51,649	45,536	34,788	64,682	12,049

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

[1] Net volume of all live trees 5 inches d.b.h. and larger from a 1-foot stump to a 4-inch top diameter outside bark.

Table 6. -- *Net volume of all live trees and salvable dead trees on timberland by class of timber and major species group, Shawnee National Forest, Illinois, 1998*

(In thousand cubic feet)

		Major species group			
Class of timber	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
Live trees					
Growing-stock trees					
Sawtimber					
Saw-log portion	284,233	31,120	1,057	48,811	203,246
Upper stem portion	39,110	3,961	159	6,594	28,396
Total	323,343	35,081	1,216	55,405	231,641
Poletimber	94,918	12,315	1,421	25,847	55,335
All growing-stock trees	418,261	47,396	2,636	81,252	286,976
Cull trees					
Short-log trees	4,883	- -	- -	1,535	3,348
Rough trees[1]					
Sawtimber size	3,651	- -	114	1,087	2,449
Poletimber size	6,740	21	78	3,339	3,301
Total	10,391	21	193	4,427	5,750
Rotten trees[1]					
Sawtimber size	4,045	- -	- -	351	3,694
Poletimber size	747	- -	- -	615	132
Total	4,792	- -	0	966	3,826
All live cull trees	20,066	21	193	6,927	12,925
All live trees	438,326	47,417	2,829	88,179	299,901
Salvable dead trees					
Sawtimber size	4,062	302	- -	1,582	2,177
Poletimber size	2,136	214	116	691	1,115
All salvable dead trees	6,198	517	116	2,273	3,292
All classes	444,524	47,934	2,944	90,453	303,193

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

[1] Includes noncommercial species.

Table 7. -- *Net volume of growing stock on timberland by species group and forest type group/local type, Shawnee National Forest, Illinois, 1998*

(In thousand cubic feet)

		Forest type group/local type													
		White-red-jack pine	Loblolly-shortleaf pine	Oak-pine				Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch			Aspen-birch	Non-stocked
Species group	All types	White pine	Shortleaf-Virginia pine	Total	Eastern redcedar	Eastern redcedar-hardwood	Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwooc	Total	Maple-beech	Cherry-ash-yellow poplar	Aspen-birch	Non-stocked
Softwoods															
White pine	7,637	5,027	--	1,958	--	--	1,958	--	--	--	653	653	--	--	--
Loblolly pine	3,164	--	--	--	--	--	--	1,810	--	1,354	--	--	--	--	--
Shortleaf pine	36,595	--	25,548	6,774	--	--	6,774	3,779	--	--	494	494	--	--	--
Eastern redcedar	2,636	--	111	765	307	437	21	1,681	23	--	56	56	--	--	--
Total	50,032	5,027	25,659	9,497	307	437	8,753	7,271	23	1,354	1,203	1,203	--	--	--
Hardwoods															
Select white oak	82,637	--	--	685	226	459	--	78,167	--	49	3,735	3,735	--	--	--
Other white oak	19,332	--	--	1,602	78	610	914	17,730	--	--	--	--	--	--	--
Select red oak	30,815	--	--	256	256	--	--	30,559	--	--	--	--	--	--	--
Other red oak	62,601	--	274	2,075	518	978	578	54,948	92	--	5,213	4,807	406	--	--
Select hickory	20,419	--	--	50	--	50	--	18,519	--	--	1,850	1,850	--	--	--
Other hickory	34,961	--	--	1,491	297	1,194	--	32,060	--	232	1,178	1,178	--	--	--
Beech	8,687	--	--	--	--	--	--	99	--	--	8,588	8,588	--	--	--
Hard maple	22,613	--	138	--	--	--	--	11,907	--	675	9,894	9,894	--	--	--
Soft maple	3,088	--	170	1,816	--	--	1,816	447	57	562	35	--	35	--	--
Elm	12,622	--	347	341	--	63	278	4,368	170	2,776	4,619	4,619	--	--	--
White & green ash	9,256	--	118	226	--	175	51	7,294	--	65	1,554	1,526	29	--	--
Sycamore	1,915	--	46	--	--	--	--	548	--	1,321	--	--	--	--	--
Willow	250	250	--	--	--	--	--	--	--	--	--	--	--	--	--
Hackberry	459	--	195	--	--	--	--	--	--	--	264	264	--	--	--
River birch	136	--	--	136	--	--	136	--	--	--	--	--	--	--	--
Sweetgum	9,868	--	--	32	--	--	32	2,403	5,297	34	2,103	2,103	--	--	--
Tupelo	5,220	--	219	53	--	53	--	1,724	--	3,185	40	--	40	--	--
Black cherry	927	345	29	101	--	--	101	269	20	--	164	27	136	--	--
Black walnut	2,408	--	--	188	--	--	188	654	--	--	1,566	1,566	--	--	--
Yellow-poplar	32,959	95	5,146	1,022	--	698	324	10,215	274	--	16,206	7,904	8,302	--	--
Other hardwoods	7,055	26	240	338	--	24	315	5,009	--	701	740	740	--	--	--
Total	368,228	717	6,923	10,411	1,375	4,304	4,732	276,919	5,910	9,600	57,749	48,801	8,948	--	--
All species	418,261	5,743	32,581	19,908	1,682	4,741	13,485	284,190	5,932	10,954	58,952	50,004	8,948	--	--

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

Table 8. -- *Net volume of growing stock on timberland by species group and diameter class, Shawnee National Forest, Illinois, 1998*

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height)								
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods											
White pine	7,637	866	1,617	1,393	2,373	763	625	- -	- -	- -	- -
Loblolly pine	3,164	57	102	280	446	393	- -	- -	1,886	- -	- -
Shortleaf pine	36,595	2,730	6,942	10,329	7,100	6,306	1,722	622	844	- -	- -
Eastern redcedar	2,636	842	579	530	368	318	- -	- -	- -	- -	- -
Total softwoods	50,032	4,496	9,240	12,531	10,287	7,779	2,347	622	2,730	- -	- -
Hardwoods											
Select white oak	82,637	2,286	3,310	6,802	5,572	10,889	14,298	10,146	8,058	19,244	2,033
Other white oak	19,332	345	1,937	1,683	2,674	2,512	2,938	1,632	1,520	4,091	- -
Select red oak	30,815	518	745	490	3,019	3,769	3,735	3,317	7,151	8,072	- -
Other red oak	62,601	939	2,245	2,759	4,951	6,565	9,086	11,417	8,015	16,625	- -
Select hickory	20,419	1,701	2,870	3,321	2,872	4,025	3,323	1,613	693	- -	- -
Other hickory	34,961	1,811	3,084	6,165	7,905	6,811	4,240	2,985	895	1,065	- -
Beech	8,687	46	236	369	555	1,772	1,822	871	- -	3,016	- -
Hard maple	22,613	3,755	2,507	2,188	2,589	3,160	3,976	3,349	- -	1,089	- -
Soft maple	3,088	399	228	312	595	1,114	440	- -	- -	- -	- -
Elm	12,622	2,098	1,866	1,057	1,696	1,108	929	613	1,758	1,498	- -
White & green ash	9,256	627	1,249	1,344	1,813	1,424	560	2,240	- -	- -	- -
Sycamore	1,915	46	- -	173	- -	375	- -	- -	- -	1,321	- -
Willow	250	50	200	- -	- -	- -	- -	- -	- -	- -	- -
Hackberry	459	28	105	140	186	- -	- -	- -	- -	- -	- -
River birch	136	- -	136	- -	- -	- -	- -	- -	- -	- -	- -
Sweetgum	9,868	1,076	2,077	1,667	2,144	1,680	574	650	- -	- -	- -
Tupelo	5,220	353	439	268	664	312	- -	- -	- -	- -	3,185
Black cherry	927	224	412	116	175	- -	- -	- -	- -	- -	- -
Black walnut	2,408	148	110	462	247	254	- -	- -	- -	1,187	- -
Yellow-poplar	32,959	959	2,220	1,934	2,574	3,700	1,273	6,081	2,340	5,049	6,831
Other hardwoods	7,055	2,241	2,050	2,259	505	- -	- -	- -	- -	- -	- -
Total hardwoods	368,228	19,649	28,024	33,509	40,735	49,471	47,192	44,914	30,430	62,255	12,049
All species	418,261	24,145	37,264	46,040	51,022	57,250	49,540	45,536	33,159	62,255	12,049

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

Table 9. -- *Net volume of growing stock on timberland by forest type group/local type and major species group, Shawnee National Forest, Illinois, 1998*

(In thousand cubic feet)

Forest type group/ local type	All species	Major species group			
		Pine	Other softwoods	Soft hardwoods	Hard hardwoods
Softwood type groups					
White-red-jack pine					
White pine	5,743	5,027	- -	691	26
Total	5,743	5,027	- -	691	26
Loblolly-shortleaf pine					
Shortleaf-virginia pine	32,581	25,548	111	6,444	478
Total	32,581	25,548	111	6,444	478
Oak-pine					
Eastern redcedar	1,682	- -	307	- -	1,375
Eastern redcedar-hardwood	4,741	- -	437	1,013	3,291
Oak-pine	13,485	8,732	21	2,877	1,855
Total	19,908	8,732	765	3,890	6,521
All softwood types	58,233	39,306	876	11,025	7,026
Hardwood type groups					
Oak-hickory					
Oak-hickory	284,190	5,589	1,681	31,041	245,878
Total	284,190	5,589	1,681	31,041	245,878
Oak-gum-cypress					
Oak-gum-cypress	5,932	- -	23	5,818	92
Total	5,932	- -	23	5,818	92
Elm-ash-cottonwood					
Elm-ash-cottonwood	10,954	1,354	- -	7,997	1,603
Total	10,954	1,354	- -	7,997	1,603
Maple-beech-birch					
Maple-beech	50,004	1,147	56	16,830	31,971
Cherry-ash-yellow poplar	8,948	- -	- -	8,542	406
Total	58,952	1,147	56	25,372	32,377
All hardwood types	360,028	8,090	1,760	70,227	279,950
Nonstocked	- -	- -	- -	- -	- -
All forest types	418,261	47,396	2,636	81,252	286,976

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

Table 10. -- *Net volume of growing stock on timberland by species group, Shawnee National Forest, Illinois, 1985 and 1998*

(In thousand cubic feet)

Species group	1985	1998
Softwoods		
White pine	622	7,637
Loblolly pine	741	3,164
Shortleaf pine	40,840	36,595
Eastern redcedar	673	2,636
Total softwoods	42,877	50,032
Hardwoods		
Select white oak	50,801	82,637
Other white oak	14,065	19,332
Select red oak	20,682	30,815
Other red oak	57,336	62,601
Select hickory	10,840	20,419
Other hickory	26,686	34,961
Basswood	375	- -
Beech	5,284	8,687
Hard maple	13,536	22,613
Soft maple	1,765	3,088
Elm	8,602	12,622
White & green ash	7,838	9,256
Sycamore	4,823	1,915
Willow	- -	250
Hackberry	407	459
River birch	1,412	136
Sweetgum	5,575	9,868
Tupelo	4,249	5,220
Black cherry	411	927
Black walnut	1,710	2,408
Butternut	208	- -
Yellow-poplar	12,203	32,959
Other hardwoods	9,081	7,055
Total hardwoods	257,888	368,228
All species	300,765	418,261

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

Table 11. -- *Net volume of sawtimber (International 1/4-inch rule) on timberland by species group, Shawnee National Forest, Illinois, 1985 and 1998*

(In thousand board feet)[1]

Species group	1985	1998
Softwoods		
White pine	- -	22,464
Loblolly pine	2,294	15,493
Shortleaf pine	78,037	135,588
Eastern redcedar	2,317	6,331
Total softwoods	82,648	179,875
Hardwoods		
Select white oak	187,373	323,823
Other white oak	46,085	75,772
Select red oak	83,616	142,130
Other red oak	244,518	275,260
Select hickory	30,851	60,565
Other hickory	75,437	119,282
Basswood	966	- -
Beech	23,970	39,757
Hard maple	36,800	68,053
Soft maple	2,226	9,394
Elm	11,225	34,291
White & green ash	23,310	28,021
Sycamore	22,968	8,425
Hackberry	- -	913
River birch	4,844	- -
Sweetgum	15,569	22,945
Tupelo	13,459	15,812
Black cherry	- -	800
Black walnut	2,476	7,723
Butternut	948	- -
Yellow-poplar	46,754	143,978
Other hardwoods	20,389	2,315
Total hardwoods	893,785	1,379,261
All species	976,433	1,559,136

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand board feet. Columns and rows may not add to their totals due to rounding.

[1] International 1/4-inch rule.

Table 12. -- *Net volume of sawtimber (Doyle rule) on timberland by species group, Shawnee National Forest, Illinois, 1985 and 1998*

(In thousand board feet)[1]

Species group	1985	1998
Softwoods		
White pine	- -	10,954
Loblolly pine	1,308	11,238
Shortleaf pine	32,638	66,637
Eastern redcedar	1,082	2,823
Total softwoods	35,028	91,653
Hardwoods		
Select white oak	114,296	214,575
Other white oak	27,186	46,744
Select red oak	52,529	96,080
Other red oak	157,775	181,841
Select hickory	17,168	32,747
Other hickory	41,620	63,450
Basswood	757	- -
Beech	17,784	25,364
Hard maple	20,504	38,836
Soft maple	1,139	4,712
Elm	5,953	21,385
White & green ash	14,114	15,312
Sycamore	16,530	6,114
Hackberry	- -	381
River birch	2,642	- -
Sweetgum	8,419	11,442
Tupelo	8,094	14,857
Black cherry	- -	334
Black walnut	1,646	5,554
Butternut	485	- -
Yellow-poplar	34,716	108,163
Other hardwoods	10,818	966
Total hardwoods	554,175	888,857
All species	589,203	980,510

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand board feet. Columns and rows may not add to their totals due to rounding.

[1] Doyle rule.

Table 13. -- *Net volume of sawtimber (International 1/4-inch rule) on timberland by species group and diameter class, Shawnee National Forest, Illinois, 1998*

(In thousand board feet) [1]

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
White pine	22,464	5,964	10,323	3,360	2,817	- -	- -	- -	- -
Loblolly pine	15,493	1,354	2,222	1,970	- -	- -	9,948	- -	- -
Shortleaf pine	135,588	50,575	35,770	32,359	9,038	3,304	4,541	- -	- -
Eastern redcedar	6,331	2,914	1,904	1,512	- -	- -	- -	- -	- -
Total softwoods	179,875	60,807	50,219	39,201	11,855	3,304	14,489	- -	- -
Hardwoods									
Select white oak	323,823	- -	27,358	52,579	67,689	47,124	36,621	84,160	8,291
Other white oak	75,772	- -	13,145	12,555	14,755	8,039	7,415	19,864	- -
Select red oak	142,130	- -	14,966	18,781	18,670	16,501	35,243	37,970	- -
Other red oak	275,260	- -	24,546	32,453	44,899	56,055	38,853	78,455	- -
Select hickory	60,565	- -	13,848	19,435	16,095	7,803	3,384	- -	- -
Other hickory	119,282	- -	39,401	34,028	21,233	14,918	4,442	5,260	- -
Beech	39,757	- -	2,805	8,920	9,104	4,322	- -	14,606	- -
Hard maple	68,053	- -	12,425	15,274	19,153	16,102	- -	5,100	- -
Soft maple	9,394	- -	2,576	4,886	1,932	- -	- -	- -	- -
Elm	34,291	- -	8,022	5,202	4,324	2,695	7,778	6,270	- -
White & green ash	28,021	- -	8,164	6,589	2,647	10,621	- -	- -	- -
Sycamore	8,425	- -	- -	1,777	- -	- -	- -	6,648	- -
Hackberry	913	- -	913	- -	- -	- -	- -	- -	- -
Sweetgum	22,945	- -	9,770	7,649	2,593	2,932	- -	- -	- -
Tupelo	15,812	- -	3,058	1,435	- -	- -	- -	- -	11,319
Black cherry	800	- -	800	- -	- -	- -	- -	- -	- -
Black walnut	7,723	- -	1,159	1,228	- -	- -	- -	5,336	- -
Yellow-poplar	143,978	- -	12,895	19,413	6,738	32,441	12,585	26,849	33,058
Other hardwoods	2,315	- -	2,315	- -	- -	- -	- -	- -	- -
Total hardwoods	1,379,261	- -	198,168	242,205	229,830	219,552	146,320	290,517	52,669
All species	1,559,136	60,807	248,387	281,407	241,685	222,856	160,809	290,517	52,669

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand board feet. Columns and rows may not add to their totals due to rounding.

[1] International 1/4-inch rule.

Table 14. -- *Net volume of sawtimber (Doyle rule) on timberland by species group and diameter class, Shawnee National Forest, Illinois, 1998*

(In thousand board feet) [1]

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
White pine	10,954	2,061	4,934	2,014	1,946	- -	- -	- -	- -
Loblolly pine	11,238	468	1,062	1,180	- -	- -	8,528	- -	- -
Shortleaf pine	66,637	17,474	17,098	19,390	6,244	2,539	3,893	- -	- -
Eastern redcedar	2,823	1,007	910	906	- -	- -	- -	- -	- -
Total softwoods	91,653	21,009	24,005	23,490	8,189	2,539	12,421	- -	- -
Hardwoods									
Select white oak	214,575	- -	11,414	26,910	39,815	30,956	26,294	69,777	9,409
Other white oak	46,744	- -	5,484	6,425	8,679	5,281	5,324	15,551	- -
Select red oak	96,080	- -	6,244	9,612	10,981	10,839	25,304	33,099	- -
Other red oak	181,841	- -	10,241	16,609	26,409	36,823	27,896	63,863	- -
Select hickory	32,747	- -	5,777	9,947	9,467	5,126	2,430	- -	- -
Other hickory	63,450	- -	16,438	17,415	12,489	9,799	3,189	4,118	- -
Beech	25,364	- -	1,170	4,565	5,355	2,839	- -	11,435	- -
Hard maple	38,836	- -	5,184	7,817	11,266	10,577	- -	3,993	- -
Soft maple	4,712	- -	1,075	2,501	1,136	- -	- -	- -	- -
Elm	21,385	- -	3,347	2,662	2,543	1,771	5,584	5,478	- -
White & green ash	15,312	- -	3,406	3,372	1,557	6,977	- -	- -	- -
Sycamore	6,114	- -	- -	910	- -	- -	- -	5,204	- -
Hackberry	381	- -	381	- -	- -	- -	- -	- -	- -
Sweetgum	11,442	- -	4,076	3,915	1,525	1,926	- -	- -	- -
Tupelo	14,857	- -	1,276	734	- -	- -	- -	- -	12,846
Black cherry	334	- -	334	- -	- -	- -	- -	- -	- -
Black walnut	5,554	- -	484	629	- -	- -	- -	4,441	- -
Yellow-poplar	108,163	- -	5,380	9,936	3,963	21,310	9,036	21,020	37,518
Other hardwoods	966	- -	966	- -	- -	- -	- -	- -	- -
Total hardwoods	888,857	- -	82,676	123,961	135,186	144,223	105,058	237,980	59,774
All species	980,510	21,009	106,680	147,450	143,375	146,763	117,479	237,980	59,774

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand board feet. Columns and rows may not add to their totals due to rounding.

[1] Doyle rule.

Table 15. -- *Average annual net growth of growing stock on timberland by species group and forest type group/local type, Shawnee National Forest, Illinois, 1985-1997*

(In thousand cubic feet)

		Forest type group/local type													
		White-red-jack pine	Loblolly-shortleaf pine	Oak-pine				Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch			Aspen-birch	Non-stocked
Species group	All types	White pine	Shortleaf-Virginia pine	Total	Eastern redcedar	Eastern redcedar-hardwood	Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Total	Maple-beech	Cherry-ash-yellow poplar	Aspen-birch	Non-stocked
Softwoods															
White pine	691	340	- -	249	- -	- -	249	- -	- -	- -	102	102	- -	- -	- -
Loblolly pine	273	- -	- -	- -	- -	- -	- -	256	- -	- -	- -	- -	- -	- -	16
Shortleaf pine	1,068	- -	718	223	- -	29	194	111	- -	- -	16	16	- -	- -	- -
Eastern redcedar	202	- -	- -	90	35	54	- -	104	- -	- -	- -	- -	- -	- -	8
Total	2,234	340	718	561	35	83	443	471	- -	- -	118	118	- -	- -	25
Hardwoods															
Select white oak	2,313	- -	- -	3	2	1	- -	2,075	- -	- -	233	215	18	- -	3
Other white oak	331	- -	- -	18	12	9	-3	313	- -	- -	-1	-1	- -	- -	- -
Select red oak	1,078	- -	4	21	20	2	- -	769	3	- -	281	241	40	- -	- -
Other red oak	2,121	- -	- -	60	42	10	8	1,802	63	98	97	70	27	- -	- -
Select hickory	356	- -	- -	2	- -	2	- -	336	- -	- -	19	2	17	- -	- -
Other hickory	1,158	- -	- -	22	17	4	1	1,019	- -	- -	117	102	15	- -	- -
Basswood	-34	- -	- -	- -	- -	- -	- -	-34	- -	- -	0	0	- -	- -	- -
Beech	57	- -	- -	- -	- -	- -	- -	46	- -	- -	11	11	- -	- -	- -
Hard maple	630	- -	- -	- -	- -	- -	- -	303	- -	18	309	300	9	- -	- -
Soft maple	159	- -	5	65	- -	- -	65	38	- -	51	- -	- -	- -	- -	- -
Elm	404	- -	27	10	- -	9	1	147	49	49	123	125	-2	- -	- -
White & green ash	379	- -	- -	20	4	0	16	240	- -	-4	122	119	3	- -	- -
Sycamore	187	- -	- -	- -	- -	- -	- -	83	- -	60	45	45	- -	- -	- -
Willow	33	- -	- -	- -	- -	- -	- -	- -	- -	33	- -	- -	- -	- -	- -
Hackberry	44	- -	3	- -	- -	- -	- -	-6	1	- -	46	46	- -	- -	- -
River birch	27	- -	- -	15	- -	- -	15	10	- -	2	- -	- -	- -	- -	- -
Sweetgum	455	- -	- -	2	- -	- -	2	100	226	2	126	126	- -	- -	- -
Tupelo	164	- -	- -	10	- -	10	- -	103	- -	26	25	24	1	- -	- -
Black cherry	67	- -	- -	21	- -	- -	21	29	1	- -	17	17	- -	- -	- -
Black walnut	170	- -	- -	0	- -	- -	0	54	28	- -	89	89	- -	- -	- -
Butternut	3	- -	- -	- -	- -	- -	- -	- -	- -	- -	3	3	- -	- -	- -
Yellow-poplar	1,641	16	42	92	- -	55	37	778	29	153	531	296	235	- -	- -
Other hardwoods	332	- -	61	29	- -	- -	29	158	- -	57	27	27	- -	- -	- -
Total	12,075	16	142	389	96	102	190	8,361	401	545	2,218	1,855	363	- -	3
All species	14,309	357	860	950	132	186	633	8,832	401	545	2,336	1,973	363	- -	27

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

Table 16. -- *Average annual net growth and average annual removals of growing stock and sawtimber (International 1/4-inch rule) on timberland by species group, Shawnee National Forest, Illinois, 1985-1997*

	Growing stock		Sawtimber	
Species group	Average annual net growth	Average annual removals	Average annual net growth	Average annual removals
	(In thousand cubic feet)		(In thousand board feet)[1]	
Softwoods				
White pine	691	- -	2,053	- -
Loblolly pine	273	- -	1,282	- -
Shortleaf pine	1,068	746	6,081	2,354
Eastern redcedar	202	- -	411	- -
Total softwoods	2,234	746	9,827	2,354
Hardwoods				
Select white oak	2,313	427	10,592	1,720
Other white oak	331	7	1,409	- -
Select red oak	1,078	177	5,456	790
Other red oak	2,121	806	9,982	3,282
Select hickory	356	179	1,346	764
Other hickory	1,158	193	5,726	625
Basswood	-34	- -	-167	- -
Beech	57	127	431	611
Hard maple	630	209	2,096	268
Soft maple	159	- -	797	- -
Elm	404	101	1,142	78
Black ash	- -	- -	- -	- -
White & green ash	379	244	1,339	1,151
Sycamore	187	292	892	1,382
Willow	33	- -	132	- -
Hackberry	44	16	99	- -
River birch	27	- -	18	- -
Sweetgum	455	59	1,869	269
Tupelo	164	119	464	475
Black cherry	67	- -	294	- -
Black walnut	170	11	657	- -
Butternut	3	- -	11	- -
Yellow-poplar	1,641	185	8,066	780
Other hardwoods	332	75	493	81
Total hardwood	12,075	3,227	53,144	12,276
All species	14,309	3,973	62,971	14,630

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic/board feet. Columns and rows may not add to their totals due to rounding.

[1] International 1/4-inch rule.

Table 17. -- *Average annual net growth and average annual removals of growing stock and sawtimber (Doyle rule) on timberland by species group, Shawnee National Forest, Illinois, 1985-1997*

	Growing stock		Sawtimber	
Species group	Average annual net growth	Average annual removals	Average annual net growth	Average annual removals
	(In thousand cubic feet)		(In thousand board feet)[1]	
Softwoods				
White pine	691	- -	952	- -
Loblolly pine	273	- -	655	- -
Shortleaf pine	1,068	746	2,477	1,125
Eastern redcedar	202	- -	166	- -
Total softwoods	2,234	746	4,250	1,125
Hardwoods				
Select white oak	2,313	427	6,080	1,052
Other white oak	331	7	662	- -
Select red oak	1,078	177	3,384	533
Other red oak	2,121	806	5,956	1,993
Select hickory	356	179	548	456
Other hickory	1,158	193	2,991	368
Basswood	-34	- -	-152	- -
Beech	57	127	263	455
Hard maple	630	209	1,035	147
Soft maple	159	- -	455	- -
Elm	404	101	646	33
Black ash	- -	- -	- -	- -
White & green ash	379	244	780	743
Sycamore	187	292	534	985
Willow	33	- -	125	- -
Hackberry	44	16	82	- -
River birch	27	- -	11	- -
Sweetgum	455	59	1,002	126
Tupelo	164	119	268	318
Black cherry	67	- -	152	- -
Black walnut	170	11	353	- -
Butternut	3	- -	6	- -
Yellow-poplar	1,641	185	4,983	809
Other hardwoods	332	75	203	41
Total hardwood	12,075	3,227	30,369	8,058
All species	14,309	3,973	34,618	9,183

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic/board feet. Columns and rows may not add to their totals due to rounding.

[1] Doyle rule.

Table 18. -- *Average annual mortality of growing stock and sawtimber (International 1/4-inch rule) on timberland by species group, Shawnee National Forest, Illinois, 1985-1997*

Species group	Growing stock average annual mortality	Sawtimber average annual mortality
	(In thousand cubic feet)	(In thousand board feet)[1]
Softwoods		
White pine	11	- -
Loblolly pine	10	- -
Shortleaf pine	186	157
Eastern redcedar	- -	- -
Total softwoods	206	157
Hardwoods		
Select white oak	263	438
Other white oak	154	229
Select red oak	479	895
Other red oak	836	1,785
Select hickory	165	508
Other hickory	189	544
Basswood	19	94
Beech	35	85
Hard maple	100	327
Soft maple	1	- -
Elm	283	312
Black ash	- -	- -
White & green ash	239	640
Sycamore	- -	- -
Willow	- -	- -
Hackberry	18	- -
River birch	57	107
Sweetgum	45	106
Tupelo	- -	- -
Black cherry	- -	- -
Black walnut	3	- -
Butternut	- -	- -
Yellow-poplar	70	132
Other hardwoods	205	366
Total hardwoods	3,159	6,568
All species	3,366	6,725

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic/board feet. Columns and rows may not add to their totals due to rounding.

[1] International 1/4-inch rule.

Table 19. -- *Average annual mortality of growing stock and sawtimber (Doyle rule) on timberland by species group, Shawnee National Forest, Illinois, 1985-1997*

Species group	Growing stock average annual mortality	Sawtimber average annual mortality
	(In thousand cubic feet)	(In thousand board feet)[1]
Softwoods		
White pine	11	- -
Loblolly pine	10	- -
Shortleaf pine	186	54
Eastern redcedar	- -	- -
Total softwoods	206	54
Hardwoods		
Select white oak	263	307
Other white oak	154	161
Select red oak	479	624
Other red oak	836	1,171
Select hickory	165	339
Other hickory	189	321
Basswood	19	94
Beech	35	85
Hard maple	100	147
Soft maple	1	- -
Elm	283	187
Black ash	- -	- -
White & green ash	239	518
Sycamore	- -	- -
Willow	- -	- -
Hackberry	18	- -
River birch	57	45
Sweetgum	45	54
Tupelo	- -	- -
Black cherry	- -	- -
Black walnut	3	- -
Butternut	- -	- -
Yellow-poplar	70	68
Other hardwoods	205	194
Total hardwoods	3,159	4,314
All species	3,366	4,368

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic/board feet. Columns and rows may not add to their totals due to rounding.

[1] Doyle rule.

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Haugen, David E.

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The inventory of forest resources of the Shawnee National Forest reports 273.2 thousand acres of forest land, of which 249.3 thousand acres are timberland. This bulletin presents an analysis of forest resources focusing on change in tree species composition, timber volume, growth, removals, and mortality.

KEY WORDS: Shawnee National Forest, forest area, forest composition, timber volume, growth, removals, mortality.

The Forest Inventory and Analysis web site is:
www.fia.fs.fed.us

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USDA Forest Service
1992 Folwell Ave., St. Paul, MN 55108

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